

February 15, 2008

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Via E-Mail

Mr. Terry Darton
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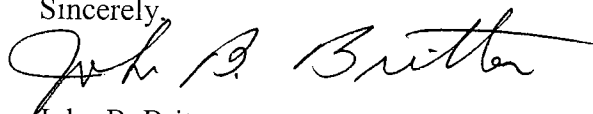
**Re: Proposed Stationery Source Permit to Operate Dated December 21, 2007
("2-stack permit"); Mirant Potomac River Generating Station, Alexandria,
Virginia**

Dear Mr. Darton:

On behalf of the City of Alexandria, I respectfully submit the attached revised Earth Tech, Inc. Technical Report entitled "Evaluation of Health Effect for Increased PM^{2.5} to Residents Near the Potomac River Generating Station (PRGS)," dated February 15, 2008. This report replaces the Earth Tech Technical Report submitted to you on January 29, 2008 as part of the record for the above-referenced permit. The analysis shows an alarming level of premature mortality and mortality-related costs for a relatively small population in the assessment grid in Alexandria as a result of emissions of fine particulate matter from Mirant's Potomac River Plant.

If you have any questions, please contact me.

Sincerely,



John B. Britton

Schnader Harrison Segal and Lewis LLP

JBB/tsg
Attachment

cc: The Honorable James P. Moran
The Honorable Tim Kaine
The Honorable L. Preston Bryant, Jr.

Mr. Terry Darton
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The Honorable Richard L. Saslaw, Senate of Virginia
The Honorable Patricia S. Ticer, Senate of Virginia
The Honorable Mary Margaret Whipple, Senate of Virginia
The Honorable Bob Brink, Virginia House of Delegates
The Honorable Adam P. Ebbin, Virginia House of Delegates
The Honorable David L. Englin, Virginia House of Delegates
The Honorable Al Eisenberg, Virginia House of Delegates
The Honorable Brian J. Moran, Virginia House of Delegates
The Honorable Mayor and Members of City Council
David Paylor, VDEQ
Richard Weeks, VDEQ
Richard Langford, Chairman, VDEQ Air Pollution Control Board
Vivian Thomson, Vice-Chairman, VDEQ Air Pollution Control Board
Bruce Buckheit, VDEQ Air Pollution Control Board
John Hanson, VDEQ Air Pollution Control Board
Hullihen Moore, VDEQ Air Pollution Control Board
James K. Hartman, City of Alexandria
Richard Baier, City of Alexandria

TECHNICAL REPORT

EVALUATION OF HEALTH EFFECTS FROM INCREASED PM_{2.5} TO RESIDENTS NEAR THE POTOMAC RIVER GENERATING STATION (PRGS)

For review of:

*Proposed Stationary Source Permit to Operate for the Mirant
Potomac River Generating Station, Alexandria, Virginia.*

December 21, 2007

Prepared by:

Earth Tech, Inc.
10 Patewood Drive
Suite 500, Building VI
Greenville, South Carolina 29615

February 15, 2008

Project No: 102856

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EXECUTIVE SUMMARY

Earth Tech has reviewed the Proposed Stationary Source Permit to Operate for the Mirant Potomac River Generating Station (PRGS), Alexandria, Virginia, Dated December 21, 2007. This State Operating Permit (SOP) addresses the operation of PRGS with two emission stacks (2-Stack) versus the current 5-stack configuration. Earth Tech reviewed the proposed SOP specifically to evaluate health effects that would result from PRGS contributions to particulate matter equal to or smaller than 2.5 micrometers (PM_{2.5}) and has developed this report to document this analysis.

Earth Tech's evaluation of health effects was conducted with modeled air concentrations calculated for each receptor based on an operating scenario allowed within the proposed SOP for PRGS that is expected to produce maximum or close-to-maximum impacts for many of the areas immediately adjacent to the PRGS. This scenario is referred to here as the "worst-case." Impacts based on this scenario were modeled using the U.S. Environmental Protection Agency (EPA) approved American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) for ground-level and elevated receptors within an 800 meter grid around PRGS and for the most highly impacted receptors at the nearby Marina Towers condominium complex (Figure 1). The health impacts were assessed using the EPA's Environmental Benefits Mapping and Analysis Program (BenMAP; Abt Associates 2007). The BenMAP elements (e.g., interpolation functions, population projections, health impact functions, valuation functions, analysis and pooling methods) are used by the EPA to conduct regulatory impact analyses (e.g., *Regulatory Impact Analysis; Control of Hazardous Air Pollutants from Mobile Sources*; EPA 2007) by translating air concentration estimates into health effect incidence estimates and monetized benefit.

The maximum daily PM_{2.5} impacts for this worst-case scenario would cause approximately 4.5 additional premature mortalities (from all causes) for the population of approximately 4,700 people estimated as living within the assessed 800 meter grid. This rate of mortality incidence would have a resulting direct cost of over \$34 million for just one year. These estimates of mortality incidence and costs were very similar, but slightly higher, to those assessed for an evaluation of adverse health effects from a maximum operating scenario allowed under the 5-stack SOP dated October 19, 2007.

Assuming PM_{2.5} impacts equivalent to the annual average increases in PM_{2.5} from PRGS versus maximum daily impacts, all-cause mortality related costs for one year would be \$6.7 million for the relatively small population estimated within the 800 meter grid. Additional health effects (i.e., lung disease, asthma, etc.) for the population assessed within the grid that could be attributable to the change in PM_{2.5} from PRGS (as modeled for the worst-case scenario) would increase the annual health-related costs to over \$37 million assuming maximum daily impacts or to \$7.2 million based on annual average impacts. These annual average costs equate to over \$1500 per person. Over a thirty-year period (2007-

2037), the net present worth of PM_{2.5} related health impacts would be nearly \$727 million assuming maximum daily impacts and nearly \$142 million assuming the annual average concentration. Analyses of health effects also indicate that residents of the Marina Towers are exposed to higher PM_{2.5} concentrations than the surrounding population and consequently would have a disproportionately higher level of adverse health effects.

These estimates were similar to an evaluation of health effects conducted by the U.S. Department of Energy (DOE) as part of a Special Environmental Analysis (SEA) for actions taken under DOE's emergency order regarding operation of the PRGS (DOE 2006). DOE determined in the SEA that during the operating period from December 1, 2006 to December 1, 2007, plant emissions would result in an increased incidence in mortality of 2.3 adults over 30-years old within the 36 square mile grid surrounding PRGS, and 23 adults over 30-years old within a population equivalent to that of the eastern United States, in this case the net present worth of PM_{2.5} related health impacts as evaluated by DOE is over \$3.5 billion for the next 30 years.

The estimates of adverse health effects (including mortality) are statistical estimates and not necessarily an absolute of what is going to occur. The statistical incidence of a particular health effect does not translate to the same risk for every individual within a population. Some individuals may be more sensitive to PM_{2.5} pollution because of their age or lifestyle. A person with asthma may react to a much lower exposure of PM_{2.5} than a healthy person and a person that spends most of their time at one location with high levels of PM_{2.5} (e.g., a sedentary or homebound person within the Marina Towers) would be more likely to experience an adverse health effect.

The analysis of health effects, and accompanying cost estimates provides for many sources of uncertainty. Although efforts were made to balance the assumptions made in the evaluation the estimated incidence rates and costs could be under- or over-estimated. The maximum operating scenario was assumed to provide protection for the most sensitive and maximally exposed individuals, but that assumption was tempered with the use of a threshold value, by addressing impacts based on PRGS contributions only, and by not accounting for combined effects of all air pollutants. The evaluation of the adverse health effects and costs presented in this document are presented primarily as a tool for risk management.

The review of the SOP indicated that the proposed operating scenarios could produce unacceptable increases in adverse health effects and associated social and economic costs. The magnitude of the health effects and the costs presented herein represent a significant impact to the residents of the City of Alexandria. It is recommended that the results of this analysis be carefully considered before approval of the SOP for PRGS is granted.

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LIST OF ACRONYMS

ACO	Administrative Consent Order
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AERMAP	AERMOD terrain preprocessor
AERMET	AERMOD meteorological data preprocessor
BenMAP	Environmental Benefits Mapping and Analysis Program
CASAC	Clean Air Scientific Advisory Committee
CDC	Centers for Disease Control
C-R	Concentration-Response
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
JAMA	Journal of the American Medical Association
MMbtu	Million British Thermal Units
NAAQS	National Ambient Air Quality Standards
NESCAUM	Northeast States for Coordinated Air Use Management
NRC	National Regulatory Council
PM _{2.5}	particulate matter ≤ 2.5 micrometers
PM ₁₀	particulate matter ≤ 10 micrometers
PRGS	Potomac River Generating Station
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
RIMS	Regional Impact Multiplier System
SAAC	Significant Allowable Ambient Concentration
SEA	Special Environmental Analysis
SO ₂	sulfur dioxide
SOP	State Operating Permit
VDEQ	Virginia Department of Environmental Quality
WTP	Willingness to Pay

1.0 INTRODUCTION

Earth Tech has reviewed the Proposed Stationary Source Permit to Operate for the Mirant Potomac River Generating Station (PRGS), Alexandria, Virginia, Dated December 21, 2007. This State Operating Permit (SOP) for the PRGS addresses the operation of PRGS with two emission stacks (2-Stack) versus the current 5-Stack configuration. PRGS is a 482 megawatt electricity generating facility located on the Potomac River in Alexandria, Virginia (Figure 1). This facility, operated by Mirant Potomac River, LLC, uses five boilers to burn coal, generating steam for electricity.

Earth Tech reviewed the proposed SOP specifically to evaluate health effects that would result from PRGS contributions to particulate matter equal to or smaller than 2.5 micrometers (PM_{2.5}). Impacts from PM_{2.5} are the focus of this evaluation, at the exclusion of other pollutants that the plant emits because 1) the emissions limits set in the SOP violates or contributes to a violation of standards; 2) PM_{2.5} is a composite of many different potentially harmful compounds; and 3) the significant amount of information linking PM_{2.5} to adverse health effects.

The SOP establishes an emissions limit for PM_{2.5} that either violates or contributes to a violation of National Ambient Air Quality Standards (NAAQS) or Virginia Significant Allowable Ambient Concentration (SAAC) guidelines.¹ NAAQS are intended to protect against the public health effects of exposure, with an adequate margin safety. However, designing facility emissions around NAAQS limits may not be sufficiently protective of public health because the U.S. Environmental Protection Agency (EPA) has adopted an annual standard that the federally-required standard-recommending panel of health experts believes is too high to be fully protective.² SAAC guidelines are established using worker health-based exposure guidelines that are scaled to account for chronic exposure; therefore, estimates of PM_{2.5} impacts based on the PRGS SOP that exceed the NAAQS or SAAC guidelines indicate the need for an evaluation of health effects related to PM_{2.5} emissions from PRGS.

PM_{2.5} is not typically made up of any one distinct compound, but can be comprised of organics, sulfates, nitrates, metals and other classes of compounds at varying fractions. While each of these compounds' impacts could be distinctly evaluated, by relying on relationships between observed levels of ambient

¹ 9 VAC 5 Chapter 50, Hazardous Air Pollutant Sources, Part II, Emission Standards, Article 4, Emission Standards for Toxic Pollutants from Existing Sources.

² Clean Air Scientific Advisory Committee Recommendations Regarding Fine National Ambient Air Quality Standards for Particulate Matter to US EPA Administrator Stephen Johnson, September 26, 2006. In this letter, CASAC states that "there is clear and convincing scientific evidence that significant adverse human-health effects occur in response to short-term and chronic particulate matter exposure at and below...the level of the current annual standard." Note also that the EPA's selection of short-term standard was the highest value in the range of values recommended by CASAC.

PM_{2.5} and reported health effects, in some part reflects the potential health effects of exposure to the wide range of chemical compositions making up PM_{2.5}. The adverse health effects associated with PM_{2.5} have been extensively documented and are discussed further in Section 2.0.

The assessment of health effects and associated economic costs described in this document were based on a scenario that approximates a maximum level of operation for PRGS allowed under the SOP and under which the plant is expected to operate relatively frequently (the worst-case scenario). Increases in ambient air concentrations of PM_{2.5} as a result of this maximum level of PRGS operation were modeled using an EPA approved air model for an area of approximately 800 meters around PRGS (Figure 2). The difference between current background concentrations of PM_{2.5} in the Alexandria area and the concentrations projected through modeling were used to evaluate health effects. The health effects were estimated based on the maximum “24-hour average” and the annual average concentration. These concentrations were modeled based on the same “worst-case” emissions scenario. This type of approach is consistent with how the EPA approaches risk to human health from facilities and sites with hazardous waste contaminated media using a “baseline” or “worst-case” approach. The “worst-case” approach is intended to assess impacts for the protection of the most sensitive and possibly maximally exposed individuals.

This evaluation of adverse health effects and associated economic costs followed the methodology used by the EPA to conduct benefit analyses for proposed air regulations (e.g., *Regulatory Impact Analysis; Control of Hazardous Air Pollutants from Mobile Sources*; EPA 2007 and *Regulatory Impact Analysis; National Ambient Air Quality Standards for Particle Pollution*; EPA 2006a) to the extent applicable. The EPA methods were followed as closely as possible, because they have been extensively reviewed by public, private and government entities. One such review, *Estimating the Public Health Benefits of Proposed Air Pollution Regulations*, was conducted by the National Research Council (NRC) and published in 2002. The critical reviews of the EPA analyses have required the EPA to use defensible methods that attempt to limit uncertainty. Elimination of all uncertainty for such complex analyses would be impossible.

The EPA’s Environmental Benefits Mapping and Analysis Program (BenMAP; Abt Associates 2007) was used to evaluate the adverse health effects and associated economic costs. BenMAP is a computer program that integrates a number of modeling elements used by the EPA to evaluate the benefits of new air regulations (e.g. the Final Clean Air Interstate Rule). These modeling elements (e.g., interpolation functions, population projections, health impact functions, valuation functions, analysis and pooling methods) have been used in previous Regulatory Impact Analyses (e.g., *Regulatory Impact Analysis; Control of Hazardous Air Pollutants from Mobile Sources*; EPA 2007) to translate modeled or monitored

air concentration estimates into health effect incidence estimates and monetized benefit, or in the case of this analysis, monetized detriment. Figure 3 illustrates the major steps in the BenMAP analysis approach.

The adverse health effects associated with $PM_{2.5}$ are discussed in Section 2.0. The methods used for the evaluation of adverse health effects related to $PM_{2.5}$ contributions under the proposed SOP for PRGS are described in Section 3.0. The results of this evaluation are discussed in Section 4.0, and the results of the Special Environmental Analysis (SEA) for PRGS conducted by the U.S. Department of Energy (DOE) and an economic evaluation for these results are presented in Section 5.0. Uncertainty is addressed in Section 6.0; the summary and conclusions in Section 7.0; and the cited references are listed in Section 8.0.

2.0 HEALTH EFFECTS ASSOCIATED WITH PM_{2.5}

The effects of airborne pollutants are well documented and are the driving force behind air quality regulations. The extensive analyses that have been conducted on air pollutants indicate a wide range of human health and welfare effects may be associated with exposure to PM_{2.5}. Potential human health effects associated with PM_{2.5} range from premature death (mortality) to illness and disease (morbidity). EPA concluded in its *Provisional Assessment of Recent Studies on Health Effects of Particulate Matter Exposure* (EPA 2006b) that long-term (chronic) and short-term (acute) exposure to fine particles is associated with both mortality and morbidity. Health effects linked to chronic and acute exposures to PM_{2.5} other than premature mortality include respiratory and cardiovascular symptoms resulting in hospital admissions, asthma exacerbations, and acute and chronic bronchitis. Impact assessments in a variety of settings have consistently identified PM_{2.5} as a major cause of premature mortality and morbidity around the world (e.g., Kunzli et al. 2000).

The mortality and morbidity effects of PM exposures appear to be induced via direct particle uptake into the blood and/or by mediation by the nervous system (EPA 2004). These effects may be especially deleterious to individuals compromised by disease states such as ischemic heart disease, cardiac arrhythmias, and Chronic Obstructive Pulmonary Disease (EPA 2004). Exposures to PM cause the release of endothelin, which could cause increased blood pressure and vasoconstriction (EPA 2004). The neurological effects of exposure may slow the heart rate and decrease cardiac output. These effects then lead to an increase in heart rate and of the force of heart contractions, which increases cardiac output (EPA 2004). These types of cardiovascular effects put strain on the heart and cardiovascular system, which can lead to cardiovascular-related health effects and mortality, particularly for sensitive individuals. The EPA reviews detailed toxicological information for PM in Volume II of the Air Quality Criteria for Particulate Matter document (2004).

Health effects associated with exposure to PM_{2.5} do not begin at any particular level of exposure such as the level established by the NAAQS. NAAQS do not represent a zero risk level. In other words, PM_{2.5} does not have a documented threshold level at which health effects begin to occur (Dockery et al. 1993, Pope et al. 1995, and Pope et al. 2002) but rather any increase in PM_{2.5} could result in an increase in health effects. The Canadian Federal Provincial Working Group on Air quality Objectives and Guidelines determined that the air quality target level for PM_{2.5} should be 7.5 µg/m³ for a 24-hour averaging time (1/2 of the U.S. NAAQS level) to realize a substantial reduction of risks to human health (Vingarzan 2002). The toxicology of PM_{2.5} is related to its components. The components of PM_{2.5} may differ based on its source. While the studies differentiating the toxicology of PM_{2.5} from different sources are preliminary, the findings suggest that combustion-related sulfate sources do contribute to the toxicity of PM_{2.5} (EPA 2006b).

3.0 ASSESSMENT METHODOLOGY

BenMAP's custom analysis was used to assess and value the potential for adverse health effects for modeled PM_{2.5} concentrations resulting from PRGS operations.

3.1 PM_{2.5} CONCENTRATIONS USED FOR ASSESSMENT

The potential for health effects from PRGS-related increases in PM_{2.5} was evaluated for the purpose of assessing the proposed (2-Stack) SOP. Modeled results were based on one of the proposed operational scenarios presented in the SOP for PRGS, specifically labeled '1D' in SOP proceedings.³ PRGS-related impacts are expected to be among the maximum potential impacts on both elevated and ground-level points of public access among all proposed operational scenarios, and represents an operational scenario which is expected to occur with relative frequency, i.e., all five boilers operate at mid-load and the associated coal and ash yard is operating at maximum capacity. The impacts were derived assuming a rate of primary PM_{2.5} of 0.055 pounds per Million British Thermal Units (MMBtu). This rate for PM_{2.5} reflects both the 1) SOP-allowed emission rate of PM₁₀ of 0.03 lb per MMBtu, used here for the primary component of PM_{2.5} because the SOP includes no explicit limit for PM_{2.5}, and 2) the conversion of sulfur dioxide to PM_{2.5}, (over and above condensation of gaseous sulfate) to PM_{2.5} at a rate of 7%,⁴ an element of total PM_{2.5} impacts that the DOE also included in a similar health effects assessment for PRGS.

Impacts were modeled based on the '1D' scenario using the applicant's own data files. These files included the following:

- Source-specific inputs to the EPA approved American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD), with the exception of emission rate for PM_{2.5} which was modified to reflect a component of sulfate conversion.
- Ground-level and elevated receptors within an 800 meter grid around PRGS and for the most highly impacted receptors at the Marina Towers condominium complex were defined using the AERMAP (AERMOD terrain preprocessor). Receptors for which impacts were simulated within the analysis are shown in Figure 2. This area of analysis was selected to maintain a conformance

³ For additional technical details on modeling assumptions specific to the SOP proceedings see memorandum of "Virginia Department of Environmental Quality (VDEQ) Technical Review of the Air Quality Analyses in Support of the Merged Stack (2-Stack) Comprehensive State Operating Permit for the Mirant—Potomac River Generating Station (PRGS)," T. Darton to M. Kiss December 21, 2007.

⁴ The SOP allows a sulfur dioxide emission rate of 0.35 lb per MMBtu. Conversion of this component at a rate of 7% in addition to a PM_{2.5} rate of 0.035 equals 0.060 lb per MMBtu; this analysis assumed a rate of 0.055 lb per MMBtu.

with use of the applicant's own modeling files and it is expected to contain all PM_{2.5} concentration peaks attributable to the PRGS PM_{2.5} impacts for operations under the '1D' scenario, and potentially other scenarios. However, some PRGS-related impacts are expected to contribute to a violation of the NAAQS at distances exceeding 800 meters.

- Meteorological conditions simulated by the model were developed using AERMET (AERMOD meteorological data preprocessor) based on 2001 data observed at the National Weather Service site at Reagan Airport during 2001 and processed using AERMET. The year 2001 was selected because meteorological conditions for this year result in impacts that are among the highest out of the five years simulated within the SOP and produced by AERMET.

The applicant's development of the AERMOD /AERMAP / AERMET data files generally conforms to procedures stipulated within the US EPA's Guideline on Air Quality Models,⁵ and more specifically to procedures described within the applicant's air quality modeling protocol (see "Revised Protocol for Modeling Ambient Pollutant Concentrations from the Existing Stacks and from the Proposed Stack Merge Project at the Potomac River Power Plant," ENSR Corporation, July 2007). AERMOD's capability to predict concentrations has been evaluated by the EPA using multiple concentration and meteorological observational data sets; results indicate that for sources where downwash occurs that AERMOD performs well.⁶ An evaluation of AERMOD's prediction capability specific to PRGS indicated that AERMOD generally over-predicts 3-hour and 24-hour impacts on Marina Towers⁷; however, this analysis did not evaluate the effect of non-site-specific meteorological inputs on AERMOD's prediction capability, nor did it evaluate prediction capability of AERMOD to evaluate impacts on other elevated receptors and ground-level receptors. Observations indicate that impacts can occur in excess of AERMOD predictions at ground-level receptors.⁸

Observations of impacts made within a wind-tunnel-scale study show that when compared to the existing 5-stack configuration the 2-stack configuration reduces, but does not eliminate, the effect of building downwash on the most highly impacted receptors immediately adjacent to the plant. The building

⁵ 40 CFR Part 51, Appendix W, "Guideline on Air Quality Models,"

⁶ "AERMOD – Latest Features and Evaluation Results," EPA-454/R-03-003, June, 2003, at www.epa.gov/ttn/scram/

⁷ "Attachment 1, A Model Evaluation Study of AERMOD Using Wind Tunnel and Ambient Measurements at Elevated Locations," Paper #198, David Shea, Olga Kostrova, Amanda MacNutt, and Robert Paine, ENSR Corporation, 2 Technology Park Drive, Westford, MA 01886, David Cramer, Mirant Corporation, 8711 Westphalia Road, Upper Marlboro, MD 20774, Larry Labrie, Mirant Corporation, 1155 Perimeter Center West, Atlanta, GA 30338-5416.

⁸ "Request for Information Relative to February 23rd Monitored SO₂ Emissions, Mirant Potomac River Generating Station, VDEQ Registration no. 70228" Jeffrey Steers, Regional Director, Virginia DEQ to Michael Stumpf, Mirant Potomac River LLC, February 27, 2007.

dimensions used in the 2-stack AERMOD analysis to characterize downwash effects derive from that site-specific wind tunnel-scale observational study.⁹

Assumptions for the AERMOD analysis conducted by the City of Alexandria are shown and compared to assumptions made by the DOE in a similar evaluation of health effects (described in more detail in Section 5.0) in Table 1. The maximum and mean daily averages of PM_{2.5} generated for a 365-day period for each receptor were used to evaluate potential health impacts for the population within the 800 meter grid area including the residents of the Marina Towers. Residents of the Marina Towers were evaluated as part of the larger 800 meter grid and independently because of the increased concentrations of PM_{2.5} that were evident within the modeled data for the upper floors of this complex.

3.2 BENMAP SETUP

A grid definition of the geographic area of interest was defined by loading a Geographic Information System (GIS) shapefile of the 800 meter grid pattern used to model the PM_{2.5} concentrations related to PRGS. A grid definition provides a method of breaking a geographic region into areas of interest (Grid Cells) for conducting population or area based analyses. The baseline and control air quality grids for PM_{2.5} were derived from AERMOD as described in Section 3.1. The baseline grid is the estimated contribution of PRGS generated PM_{2.5} only, whereas the control grid is the estimated contribution of PRGS generated PM_{2.5} added to the ambient background concentration for the area.

3.3 HEALTH EFFECTS ASSESSMENT

The health impact function is used to calculate the change in adverse health effects associated with a change in air pollution concentrations. Based on a Concentration-Response (C-R) function, a health impact function estimates the relationship between adverse health effects and changes in ambient air pollution. The health impact function relates a change in the concentration of a pollutant with a change in the incidence (occurrence) of a health endpoint (e.g., premature mortality). Inputs to health impact functions typically include (a) the change in ambient air pollution level, (b) health effect estimate, (c) the baseline incidence rate of the health endpoint (obtained from public health statistics), and (d) the exposed population. A typical health impact function might be shown as follows:

$$\Delta y = y_0 \cdot (e^{\beta \cdot \Delta x} - 1)$$

⁹ "Final Report, Wind Tunnel Modeling Evaluation for the Mirant Potomac River Generating Station," CPP, Inc., August, 2006.

Where y_0 is the baseline incidence, equal to the baseline incidence rate times the potentially affected population; β is the effect estimate; and Δx is the estimated change in the $PM_{2.5}$ ambient air concentration (Hubbell et al. 2005). The health impact function may be shown in other functional forms, but the basic elements remain the same (Hubbell et al. 2005).

The BenMAP package combines all of the elements of the health impact function to determine an estimate of the incidence of adverse health effects. Incidence estimation using BenMAP requires the user to build configurations by inputting baseline and control air quality grids, defining a population dataset and year, and choosing the health endpoints for evaluation, as well as specific epidemiological studies that report incidence rates for each chosen endpoint. Different incidence rates from multiple studies can be pooled, aggregated and/or valued by the user using a variety of statistical methods (Northeast States for Coordinated Air Use Management [NESCAUM] 2008). The BenMAP selections made for this evaluation are summarized in Table 2 for Incidence Configuration and Pooling and in Table 3 for Valuation Configuration and Pooling.

The following subsections describe the selection of a population dataset and year, the health endpoints for evaluation, and an explanation of the specific epidemiological studies that report incidence rates for each chosen endpoint.

3.3.1 Population Datasets

Potentially exposed populations were estimated by matching 2000 block-level U.S. Census data to the 800 meter, GIS-referenced grid area using an auxiliary program (PopGrid). PopGrid, a computer program developed by Abt Associates, Inc., aggregates block data from the 2000 Census to user-specified grid definitions (GIS polygon shapefiles) to produce a population data file in a format compatible with BenMAP. The population estimates were provided as a data file from PopGrid by a representative of Abt Associates to Earth Tech (personal communication between E. Schreiber of Earth Tech and H. Mahoney of Abt Associates 2007). The data are broken down by race, gender, and age.

BenMAP uses 250 age/sex/race categories to construct specific populations that correspond to the populations in each epidemiologic study by accessing the appropriate age-specific populations from the population datasets that were developed using PopGrid (Hubbell et al. 2005). BenMAP uses county-level population projections developed by Woods & Poole to project population data generated by PopGrid, which is for the year 2000, to the user's year of choice (Davidson et al. 2007). Population estimates were based on the year 2008 for this assessment. The number of people estimated within the 800 meter grid around PRGS using PopGrid was approximately 4700 and the number for the Marina Towers was

estimated to be approximately 495 (personal communication between J. Britton of Schnader Harrison Segal & Lewis and M. Harris, representative of Marina Towers).

3.3.2 Endpoints Evaluated

BenMAP uses a built-in database of hundreds of health impact functions for PM_{2.5} (and other pollutants) for different health effect endpoints. An endpoint is a subset of an endpoint group, and represents a more specific class of adverse health effects. For example, the endpoint group *Mortality* may have the endpoints of *All Cause Mortality* or *Lung Cancer* or *Cardiopulmonary Cause Mortality*. It also contains data for the rate of incidence of many health effect endpoints that also have a corresponding health function. The incidence rates are necessary to establish the baseline health analysis. The endpoints that were selected for this assessment were based on those used by the DOE in the SEA and those used by the EPA in recent Regulatory Impact Analyses (e.g., *Regulatory Impact Analysis; Control of Hazardous Air Pollutants from Mobile Sources*; EPA 2007) and are shown in Table 2. The *BenMAP User's Manual* (Abt Associates 2005) provides documentation of sources of prevalence and incidence data and the epidemiological sources of PM-related C-R functions for the health effects shown in Table 2. The uncertainty and pooling options available in the model are also discussed in the *BenMAP User's Manual*, Appendix I (Abt Associates 2005).

3.3.3 Prevalence and Incidence Data Sources

Epidemiological studies estimate the relationship between changes in air quality and the relative risk of adverse health endpoints versus the absolute number of incidences. The absolute change in incidence of an adverse health effect endpoint requires the use of the baseline incidence rate for that endpoint. The baseline rate is the change of the incidence of a particular health endpoint derived from a variety of sources including published estimates and Center of Disease Control (CDC) data. Incidence rates can be nationwide or region specific, depending on the health effects endpoint. Age specific incidence rates are available for most endpoints and are matched to the age specific population estimates within each grid cell. A complete description of incidence rates used in BenMAP is contained in the User's Manual (Abt Associates 2005).

3.3.4 Epidemiological Sources

Selection of epidemiological studies used to provide C-R functions to BenMap was based on the EPA process for evaluating the benefits of air regulations. Up-to-date assessments of the published scientific literature were conducted to ascertain the relationship between particulate matter exposure and adverse human health effects. The designers of BenMAP (EPA and Abt Associates) evaluated studies using a

variety of selection criteria, including: its location and design, the characteristics of the study population, and whether the study was peer-reviewed. Priority was given to studies that focused on PM_{2.5} and ozone, because of the focus by EPA on emissions reductions from non-road sources that are likely to result primarily in reduced ambient PM_{2.5} and ozone levels (Abt Associates 2005). If sufficient PM_{2.5} studies were available for a given health effect they were selected over PM₁₀ studies.

Studies chosen first in BenMap were multi-pollutant models with both PM and ozone, second choice studies were those with other co-pollutants, and the last choice were single pollutant models (Abt Associates 2005). Single- and multi-pollutant models each have potential advantages and disadvantages, with neither type clearly preferable over the other, however, the regulatory focus of BenMAP was on PM and ozone (Abt Associates 2005). BenMAP uses this approach because for regulatory analyses which consider two pollutants together, adding incidence changes for a given health endpoint, based on a single-pollutant PM model, to the incidence changes based on a single pollutant ozone model could result in an overestimate of incidence change, if both have an effect on the health endpoint and there is some colinearity between the two pollutants (Abt Associates 2005).

Many epidemiological studies of air pollution and health present numerous single pollutant and multi-pollutant models for the same pollutant and health endpoint and these models may differ from each other in a number of characteristics, including: the functional form of the model, the covariates included in the model, the pollutant exposure metric, the lag structure, and the study population (Abt Associates 2005). A relatively objective process was used to select among models as described in Appendix D of the *BenMap User's Guide* (Abt Associates 2005).

The parameters unique to each of the epidemiological studies chosen for the endpoints evaluated for this analysis are shown in Table 4. Specific details of each selected study such as author, pollutant of interest, location, year, age, and threshold, were collected from audit trail reports created by BenMAP. The audit trail reports are detailed reports of the specific settings and methods used in BenMAP to run incidence and valuation estimations. Audit trail reports also provide users with the coefficient and standard error of each individual study. Data used in the calculation of the coefficient and standard error (i.e. the odds ratio, relative risk, and associated 95% confidence intervals) along with BenMAP's assumption of functional form are also included in Table 4. C-R functions and their underlying parameters are briefly described along with summaries of each of the epidemiological studies available for use in Appendix F of the *BenMAP User's Manual* (Abt Associates 2005). It should be noted that the study summaries provided in Appendix F of the *BenMAP User's Manual* include coefficients and standard errors for each study. However, in most cases, these values differ slightly from those reported in the audit trail reports generated from this analysis, because the coefficients used for this analysis included the assumption of thresholds.

3.3.5 Pooling Methods

For pollutant-health endpoint combinations estimated by more than one health impact function, BenMAP provides various techniques to pool the incidence estimates. For this assessment the random/fixed effects pooling method was selected for all pooled incidence estimates. Fixed effects pooling weights each incidence estimate in proportion to the inverse of its variance and the weights used for the random effects model is basically the same as that used in a fixed effects model, but the variances used in the calculations are different. The selection of random/fixed effects pooling in BenMAP allows the program to test, using a null hypothesis, for a single underlying parameter (fixed effect pooling). If the null hypothesis is rejected, the random effects pooling method is utilized. Appendix I of the *BenMAP User's Manual* (Abt Associates 2005) provides the documentation for all weighting methods available in BenMAP.

3.4 ECONOMIC COST EVALUATION

Once BenMAP has estimated the incidence associated with a particular health effect, derived from a single health impact function or multiple pooled health impact functions, the user may estimate the economic value of that incidence based on hundreds of preloaded health effect-specific dollar values. In the same way BenMAP estimates health effects, it can also estimate both point estimates of incidence valuation and a Latin Hypercube-based distribution of incidence valuation reflecting both the uncertainty surrounding estimated incidence and the uncertainty surrounding the unit values. BenMAP also allows for the pooling of endpoint specific valuation in the same way incidence estimates are pooled. Appendix I of the *BenMAP User's Manual* (Abt Associates 2005) provides the documentation for all weighting methods available in BenMAP. Sources of cost data selected in BenMAP for this assessment are listed in Table 3.

4.0 RESULTS

Health effects and costs generated by BenMAP using modeled concentrations for the '1D' SOP operating scenario, are presented in Table 5 for maximum daily impacts of PM_{2.5} and Table 6 for annual impacts of PM_{2.5}. These incidence estimates of adverse health effects are for the relatively small population of approximately 4700¹⁰ estimated for the 800 meter grid. These results are based solely on the estimated PRGS contribution to ambient air concentrations of PM_{2.5} over the background levels of 34.1 µg/m³ (VDEQ 2007). The results do not include an estimate of health impacts including background levels. As indicated on Table 5 the predicted incidence of adult all-cause mortality based on the modeled maximum value (24-hour mean) is 4.5. This incidence rate has a 90% confidence interval (CI)¹¹ of 1.9 to 6.8 incidences; indicating a 90% certainty that the probability the actual incidence rate would not be lower than 1.9 or greater than 6.8. The direct cost of mortality based on the modeled maximum value (24-hour mean) is over \$34 million (90% CI \$4.8-\$89 million), while additional health effects (i.e., lung disease, asthma, etc.) would increase the annual health-related costs to nearly \$37 million. Over a thirty year period (2007-2037), the net present worth¹² of PM_{2.5} related health impacts assuming the maximum impacts would be \$727 million.

The estimates of mortality incidence and costs for the maximum daily impacts under the 2-stack scenario evaluated were very similar, but slightly higher, to those assessed for an evaluation of adverse health effects from a maximum operating scenario allowed under the 5-stack SOP (October 19, 2007). The estimated incidence of premature mortalities (from all causes) based on what was interpreted as the 2nd highest level of operation allowed under the 5-stack SOP for the same population within the 800 meter grid was 4.1 with associated costs for one year of approximately \$31 million. All the assumptions used to assess the impacts resulting from operation under the 5-stack SOP were the same as those for the evaluation described for the 2-stack SOP, with the exception of the differing operating scenarios. The evaluation of health effects for the 5-stack permit was based on scenario "C3E" for 2 boilers operating at the minimum load for 24 hours per day.

¹⁰ PopGrid, a computer application that assists in calculating the population level in BenMAP using 1990 and 2000 U.S. Census block data, was used to estimate the population of the grid. PopGrid is an application developed by Abt Associates that combines the Census block data with any user-specified set of population grid-cells, so long as they are defined by a GIS shapefile. This application is too large to be contained within BenMAP, so the population estimates were estimated with PopGrid by a representative of Abt Associates (personal communication between E. Schreiber of Earth Tech and H. Mahoney of Abt Associates).

¹¹ See Section 6.0 for more discussion regarding the statistics used to generate this CI and Appendix A for tables of each endpoint and corresponding mean and CI by receptor point.

¹² Net Present Worth represents costs that are estimated in current dollars, escalated to the time when they would be spent, and then corrected to a present worth using a discount rate (3%).

Estimated incidence of adverse health effects and associated costs for the average annual PM_{2.5} contributions by the PRGS over background levels are shown in Table 6. As indicated on Table 6 the predicted incidence of adult all-cause mortality based on the modeled average value (annual average) is 0.88. This incidence rate has a 90% CI of 0.31 to 1.5. The direct cost of mortality based on the modeled average value (annual average) is over \$6.7 million (90% CI \$0.9-\$18 million), for just one year for the population of only about 4700 within the 800 meter grid. Additional health effects (i.e., lung disease, asthma, etc.) related to the increase of PM_{2.5} from PRGS would increase the annual health-related costs for based on the average impacts to over \$7.2 million for the relatively small population assessed within the grid. These costs are based on modeled PRGS-related increases in PM_{2.5} levels above background levels of 14.2 µg/m³ (VDEQ 2007). The net present worth of PM_{2.5} related health impacts for the modeled, annual average concentration would be \$142 million.

Additionally, residents in the Marina Towers were evaluated separately from the 800 meter grid population, because of the higher levels of PM_{2.5} exposure for these residents based on their location relative to PRGS and the air-flow pattern around the facility. Based on the air modeling results these residents are exposed to higher PM_{2.5} concentrations than the surrounding population even with the 2-stack scenario; therefore these residents will receive a disproportionately higher level of adverse health effects. The evaluation of health effects for these residents indicated that the mortality rate for the residents of Marina Towers was 16 percent of the total predicted mortality cases for the 4700 population within the 800 meter grid, but the Marina Towers only represent 10.5 percent of the population; indicating the rate of mortality predicted for the Towers is higher than the mortality rate for the population of the 800 meter grid¹³.

The estimates of adverse health effects (including mortality) are statistical estimates and not necessarily an absolute of what is going to occur. The estimates of adverse health effects occurring are expressed as the expected incidence. DOE explains expected incidence in the SEA for PRGS with the following example. If pepper is thrown in the faces of 1000 people and 340 people sneeze, then you could expect 3.4 people in a randomly selected group of 10 individuals to also sneeze when pepper is thrown in their faces (DOE 2006). Of course, 3.4 is a statistical average and 0.4 people do not exist, so in one set of ten individuals three may sneeze, while in a different set of people four may sneeze, in another group no one may sneeze or everyone may sneeze, but the average incidence of sneezing for all of the groups is

¹³ All cause mortality rates for an estimated population of approximately 495 residents within the Marina Towers was 0.71 versus 4.47 predicted cases for the estimated population of 4700 within the 800 meter model grid.

expected to be 3.4. The statistical incidence of a particular health effect does not translate to the same risk for every individual within a population. Some individuals may be more sensitive to PM_{2.5} pollution because of their age or lifestyle. A person with asthma may react to a much lower exposure of PM_{2.5} than a healthy person and a person that spends most of their time at one location (with high levels of PM_{2.5} e.g., a sedentary or homebound person within the Marina Towers) would be more likely to experience an adverse health effect.

5.0 REVIEW AND VALUATION OF HEALTH EFFECTS DETERMINED BY DEPARTMENT OF ENERGY

DOE performed a SEA for actions taken under DOE's emergency order regarding operation of the PRGS (DOE 2006) that also addressed health effects. DOE evaluated health effects for a broader population using a grid of 36 square miles (approximately 93 square kilometers) as opposed to the City of Alexandria's evaluation for a grid of 800 meters. Assumptions used by DOE to conduct air modeling are shown in Table 1. DOE determined in the SEA that during the operating period from December 1, 2006 to December 1, 2007 plant emissions¹⁴ would result in an increased incidence in mortality of 2.3 adults over 30-years. The DOE assessment was based on operations under the EPA's Administrative Consent Order (ACO) and the ACO did not allow operation under scenarios that would have impacts as high as they would be under the '1D' scenario, i.e., 5 boilers operating at the mid-load for 24 hours per day, so the impacts estimated by DOE may be less than what is allowable under the proposed 2-stack SOP.

DOE used parameters provided by EPA to estimate health effects incidence based on total emissions of SO₂, NO_x, and PM_{2.5} for a population defined in the SEA as "roughly the population of the eastern United States" (DOE 2006). The mortality rate estimated by DOE for the eastern United States would be equivalent to a direct cost of over \$175 million for just one year (see cost figures presented in Table 7). DOE also evaluated additional health effects (other than mortality) related to the increase of PM_{2.5} from PRGS for the eastern United States. These health effects and their associated direct costs are also presented in Table 7, which shows a total annual cost of \$185 million. Over the next 30 years old within the 36 square mile grid and 23 adults over 30-years old within a population equivalent to that of the eastern United States. The DOE assessment was based on operations under the EPA's Administrative Consent Order (ACO). The mortality rate estimated by DOE for the eastern United States would be equivalent to a direct cost of over \$175 million for just one year (see cost values presented in Table 7). DOE also evaluated additional health effects (other than mortality) related to the increase of PM_{2.5} from PRGS for the eastern region. These health effects and their associated direct costs are also presented in Table 7. The net present worth of PM_{2.5} related health impacts as evaluated by DOE is over \$3.6 billion.

¹⁴ This scenario assumed a rate of primary PM_{2.5} of 0.019 lb per MMBtu. However, DOE adjusted PM_{2.5} impacts to include a secondary sulfate SO₂ component, which is presumed to be 7% of SO₂ impacts for each day and receptor, calculated using a daily-varying SO₂ emission rate. DOE used an operational output level assumed to be that allowed under the Administrative Consent Order (ACO) for five stacks.

6.0 UNCERTAINTY

The complexity of the analysis of health effects and accompanying costs estimates provides for many sources of uncertainty. These include the air quality model (with its associated parameters and inputs), population estimates, epidemiological estimates of health impact functions, and estimates of dollar values per health effect, among others. To the extent possible this evaluation followed the EPA methods used to assess benefits associated with new air regulation (EPA 2007 and 2006a) because these methods have been extensively reviewed and critiqued by the public, private industry, and other government agencies. As part of the analysis conducted for particle pollution (EPA 2006a), EPA sought the opinions of outside experts to support the characterization of uncertainty associated with reductions in exposure to particle pollution. Documentation of these opinions can be accessed at <http://www.epa.gov/ttn/ecas/ria.html>. Primary sources of uncertainty in this analysis are similar to those described by the EPA in the *Regulatory Impact Analysis; National Ambient Air Quality Standards for Particle Pollutions* (2006a) and include:

1. Uncertainties Associated with Impact Functions

- The value of the PM effect estimate in each impact function.
- Application of a single impact function to pollutant changes and populations in all locations.
- Similarity of future-year impact functions to current impact functions.
- Correct functional form of each impact function.
- Extrapolation of effect estimates beyond the range of PM concentrations observed in the source epidemiological study.
- Application of some impact functions only to those subpopulations matching the original study population.

2. Uncertainties Associated with Modeled PM_{2.5} Concentrations

- Limitations in the ability of any model to estimate actual concentrations.
- Assumptions used in the model regarding the PRGS operating scenario that are based on a scenario proposed for the SOP and may not be the same as actual operations.
- The grid area used for modeling was selected to capture the highest impacts from PRGS, but does not capture all impacts from the facility.

3. Uncertainties Associated with PM_{2.5} Mortality Risk

- Differential toxicity of specific component species within the complex mixture of PM_{2.5} has not been determined.
- The extent to which adverse health effects are associated with low-level exposures that occur many times in the year versus peak exposures.
- The extent to which effects reported in the long-term exposure studies are associated with historically higher levels of PM_{2.5} rather than the levels occurring during the period of study.
- Reliability of the limited ambient PM_{2.5} monitoring data in reflecting actual PM_{2.5} exposures.

4. Uncertainties Associated with Possible Lagged Effects

- The portion of the PM_{2.5}-related long-term exposure mortality effects associated with changes in annual PM_{2.5} levels that would occur in a single year is uncertain as well as the portion that might occur in subsequent years.

5. Uncertainties Associated with Baseline Incidence Rates

- Some baseline incidence rates are not location specific (e.g., those taken from studies) and therefore may not accurately represent the actual location-specific rates.
- Current baseline incidence rates may not approximate well baseline incidence rates in 2037.
- Projected population and demographics may not represent well future-year population and demographics.

6. Uncertainties Associated with Economic Valuation

- Unit dollar values associated with health and welfare endpoints are only estimates of mean willingness to pay (WTP) and therefore have uncertainty surrounding them.
- Mean WTP (in constant dollars) for each type of risk reduction may differ from current estimates because of differences in income or other factors.

7. Uncertainties Associated with Aggregation of Monetized Benefits

- Health and welfare cost estimates are limited to the available impact functions. Thus, unquantified or unmonetized costs are not included.

The inherent uncertainty and variability in the approaches used in an analysis of this type have been addressed by the EPA, in part, through the development of BenMAP. BenMAP was used for the analyses presented within this document to provide consistency with the EPA approach (the most peer reviewed, consistent and refined approach for health effect assessment and cost valuation) and limit, to the extent possible, inconsistencies, variability, and to some degree uncertainty. The BenMAP goals were: 1) to provide a flexible tool for systematically analyzing the impacts of changes in environmental quality in a timely fashion; 2) to make sure that stakeholders can understand the assumptions underlying the analysis; and 3) to adequately address uncertainty and variability.

To address some of the uncertainty related to the estimation of health effects and their associated costs the mean health and value estimates are provided with their corresponding five percent and 95% levels of the distribution, which corresponds to a 90% confidence interval, in Appendix A. There is a 90% probability that the true mean of the distribution is within the 90% confidence interval. BenMAP allows the user to select the “Latin Hypercube” method (similar to Monte Carlo statistical simulation analysis but considered more efficient) to sample within the distribution of possible outcomes. For this assessment, 10 Latin Hypercube sampling points were selected in the generation of incidence estimates that mirror the

variability in the inputs to the health impact function.¹⁵ Using the Latin Hypercube mode, BenMAP reflects the uncertainty surrounding estimated incidence changes (resulting from the sampling uncertainty for the pollutant coefficients in the C-R functions; Abt 2005).

Uncertainty exists in the results for modeled PM_{2.5} concentrations estimated using AERMOD. AERMOD estimated impacts will vary depending on changes in meteorological conditions and changes in facility emissions and operational characteristics. By analyzing health effects assuming day-to-day exposure of maximum daily impacts, and day-to-day exposure of annual average impacts, the range in results will to some degree reflect variation in facility operation. Improvements in the model's accuracy would result if site-specific meteorological conditions were used, if impacts were modeled for several years and for the full range of potential operational scenarios, and if particulate emissions could be characterized more accurately for PRGS. Additionally, some degree of variance between what AERMOD predicts and actual impacts will occur because of limitations in model accuracy. To date, observations of actual impacts at this site do not include observations at all areas where impacts are expected to be highest. The limited monitoring results indicate that accuracy of AERMOD predictions vary depending on location. However, in settings with downwash, EPA evaluation studies employing large numbers of monitors, placed along broad arcs of potential exposure and at various downwind locations, show that AERMOD performs well in predicting actual concentrations.

The rate of incidence and costs presented in Table 5 represent the effects from the modeled maximum concentration, and those in Table 6 represent the effects from the modeled annual average concentration for the potential worst-case emission scenario based on the proposed SOP for PRGS. When the modeled annual average (versus the 24-hour maximum average) PM_{2.5} concentration is used,¹⁶ the annual predicted cases of all-cause mortality drop to 0.88 and the related costs for one year are reduced to \$6.7 million (or a net present value of over \$130 million over the next 30 years). However, an adjusted coefficient, which applies a threshold of 7.5 to 10 µg/m³, was selected in BenMAP to derive these estimates. The selection of this value has little effect for the analysis conducted using the maximum concentrations, but it does significantly change the outcome of the annual average analyses.

The annual average analysis for all-cause mortality without an applied threshold would more than double the annual predicted cases (from 0.88 to 1.98). The increase in mortality cases increases the annual direct costs to \$15 million. In a review of methods for estimating the public health benefits of air pollution regulations, National Research Council (NRC 2002) concluded that there was no evidence for any

¹⁵ The use of 10 Latin hypercube points allows for a 90% confidence interval. BenMAP calculates the incidence estimate multiple times, adjusting the pollutant coefficient each time to describe a different level of the distribution (5th, 15th, 25th, . . . , and 95th levels) for each receptor point.

¹⁶ The number of annual predicted cases was estimated to be 0.88 using the modeled annual average concentration.

departure from linearity in the observed range of exposure to PM₁₀ or PM_{2.5}, nor any indication of a threshold. The NRC cited the weight of evidence available from both short- and long-term exposure models and the similar effects found in cities with low and high ambient concentrations of PM (NRC 2002). It is very likely that with further research on health effects at lower concentrations and with better statistical analysis of the dose-response relationship at low concentrations that levels of PM_{2.5} considered as being “safe” to human health will drop further. Therefore, the number of cases and associated costs presented in this assessment for the annual average scenario provide a lower boundary of costs, but most likely underestimate the true risks and potential costs of the evaluated scenario.

The health effect related costs presented in this document do not include an evaluation of sensitive receptors like infants and the elderly, maximally exposed people (someone that exercises everyday outside) nor do they include an evaluation of other air pollutants like (ozone, hazardous air pollutants, silica, NO_x, and SO₂) that could combine to create greater incidence of health effects or increase the severity of the health effects. Also, the incidence of health effects and associated costs are only estimated based on the amount of PM_{2.5} that is expected to be attributed by PRGS. This evaluation does not assess the additional or exponential increase of health effects/costs due to existing ambient background levels. Further, while the costs used to value health impacts may not apply to all individuals and situations they also do not take into account many secondary costs associated with illness like the loss of productivity of an individual or mental health effects of long illnesses.

Other secondary and indirect economic consequences from the loss of life, employment, earnings and production could also be considered. Indirect economic consequences may be identified by economic input-output models, such as the Regional Impact Multiplier System (RIMS) II model of the US Bureau of Economic Analysis. The multiplier effect of changes to the economy would be in reverse here, so that the original losses would be compounded by additional loss of employment, earnings and output, at least in the short term. A RIMS II multiplier computed for earnings in Northern Virginia counties cites a multiplier of 0.2173 for changes in household earnings. Thus, the loss of earnings noted in this report could be increased by a factor of almost 22%.

Other key assumptions that affected the calculation of the results, and their interpretation include the treatment of equivalent concentrations of PM_{2.5} as equally harmful. While this is a reasonable interpretation of the epidemiological evidence, the evidence is not definitive regarding the impacts of size and composition of particles (Davidson et al. 2007). Current advice from a number of scientific panels provides support for the reliance on cohort epidemiological studies measuring the impact of long term exposure to PM_{2.5} (EPA 2001, NRC 2002) and on an estimate of the value of statistical life consistent with the broader set of contingent valuation and hedonic wage literature (EPA 2000).

The C-R functions were applied to the specific populations covered by the samples in the underlying epidemiological studies, but in many cases, these samples were based solely on convenience (e.g., hospital discharge data from Medicare is limited to populations over 65) rather than on expectations about the populations potentially at risk, which would lead to an underestimation of the total health impacts associated with a given PM_{2.5} increase. Non-asthma related emergency room visits, prescription medication, chronic respiratory damage, and adverse effects on pulmonary function were not quantified by BenMAP for this evaluation. Additionally, there are non-health related impacts, such as decreased visibility and/or damaged ecosystem and agricultural crops that would add to the costs calculated in this assessment.

7.0 SUMMARY AND CONCLUSIONS

The analysis of health effects, and accompanying cost estimates provides for many sources of uncertainty, as discussed in Section 6.0. Although efforts were made to balance the assumptions made in the evaluation the estimated incidence rates and costs could be under- or over-estimated. The maximum operating scenario was assumed to provide protection for the most sensitive and maximally exposed individuals, but that assumption was tempered with the use of a threshold value, by addressing impacts based on PRGS contributions only, and by not accounting for combined effects of all air pollutants. The evaluation of the adverse health effects and costs presented in this document are presented primarily as a tool for risk management.

The review described within this document indicates that operating scenarios allowed in the SOP could produce an increase in the incidence of mortality in adults most likely somewhere between the annual average of 0.88 and maximum estimate of 4.5 or a 90%CI of 0.31 to 6.82, with the annual average based values (the lower values) most likely being too low as a result of the application of a threshold. However, even considering the lowest level of 0.31 within the confidence interval, an economic cost of \$172 dollars per each person within the grid area per year is indicated. These levels represent unacceptable increases in adverse health effects and associated social and economic costs, because they do not include all adverse health effects or costs related to the air pollutants generated by the PRGS.

The estimates of mortality incidence and costs for the maximum daily impacts under the 2-stack scenario evaluated were very similar, but slightly higher, to those assessed for an evaluation of adverse health effects from a maximum operating scenario allowed under the 5-stack SOP dated October 19, 2007. The estimated incidence of premature mortalities (from all causes) based on what was interpreted as the 2nd highest level of operation allowed under the 5-stack SOP for the same population within the 800 meter grid was 4.1 with associated costs for one year of approximately \$31 million.

To provide additional perspective to the increases in health effects that would be generated by contributions of PRGS to PM_{2.5}, estimated increases in mortality incidences were compared to risk levels developed by the EPA to determine the acceptability of releases of chemical contaminants to air, soil, groundwater, and surface water. The EPA has established in its Risk Assessment Guidelines for Superfund (EPA 1989) that a probability of cancer occurrence that is greater than one in one million (1 in 1,000,000) as a result of exposures to contaminants at hazardous waste sites is considered significant.

The impacts for mortality estimated for exposures to modeled average annual values of PM_{2.5} by the City of Alexandria would yield a risk of approximately 950 in one million¹⁷. The impacts estimated by DOE in the SEA are equivalent to 16 in one million¹⁸. These risk levels would be considered significant by the EPA in the context of a baseline risk assessment performed for a hazardous waste site. A baseline risk assessment conducted following EPA guidance would use a “worst-case” and “maximally exposed individual” approach similar to what is presented in this assessment.

The purpose of permit limitations for sources of pollutants is the avoidance of health effects. Since emissions from point sources like PRGS can be effectively reduced through the use of updated technology and logistical and environmental management practices, any increase in adverse health effects for the local population as a result of contributions from those sources is unwarranted. The magnitude of the health effects and the costs presented herein represent a significant potential risk from operation of PRGS to the residents of the City of Alexandria. Additionally, these risks appear to be proportionally larger for the population of the City of Alexandria versus the region. The adverse health effects and associated costs evaluated in this document should be carefully considered before approval of the SOP for PRGS is granted. Strict scrutiny from the regulating community should be employed to ensure engineering and management controls for PRGS operation that would prevent any adverse health effects that may be possible as indicated in this report. Additionally, the regulatory permitting process should be transparent allowing for accountability of Mirant and the State to provide for the health and welfare of the population that would be impacted by PRGS operations.

¹⁷ This estimate assumes the estimated 4.47 all-cause mortality rate for adults 30-99 years old for the entire population of the 800-meter grid.

¹⁸ Based on the rate of mortality estimated by DOE in the SEA for a population of 30 and over within 36 square miles of PRGS.

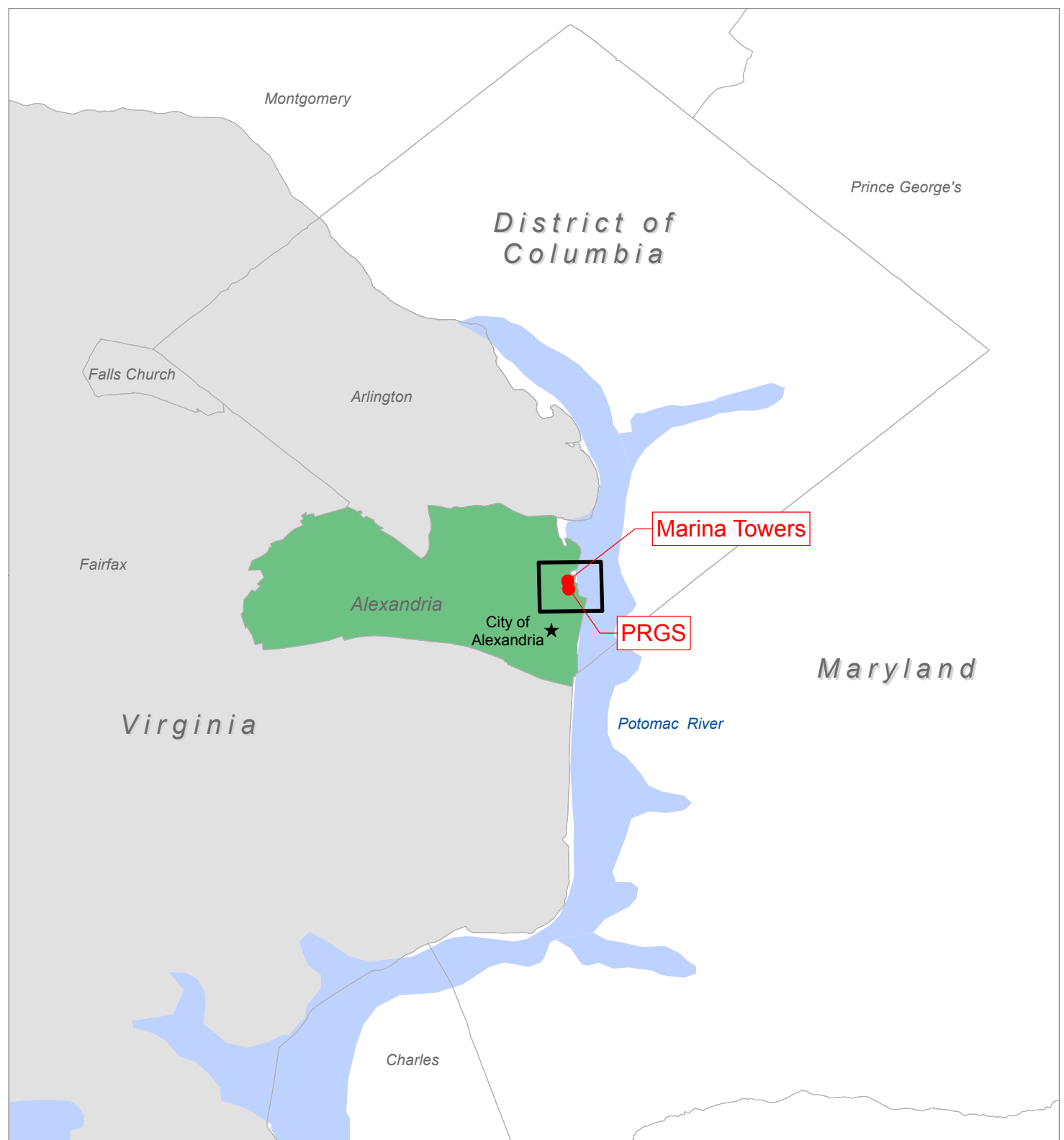
8.0 REFERENCES

- Abt Associates, 2005. BenMAP Users Manual and Technical Appendices. Available at: <http://www.epa.gov/air/benmap/docs.html>.
- Abt Associates, 2007. Environmental Benefits Mapping and Analysis Program (BenMAP). BenMAP 2.4.8 US Version. Available at: <http://www.epa.gov/air/benmap/download.html>.
- Britton J (Schnader Harrison Segal and Lewis) and Harris M (Marina Towers representative). 2008. Email communication from Harris to Britton containing the population estimate for the Marina Towers condominium complex. January 25, 2008.
- Davidson K, Hallberg A, McCubbin D, Hubbell B. 2007. Analysis of PM_{2.5} Using the Environmental Benefits Mapping and Analysis Program (BenMAP). *Journal of Toxicology and Environmental Health*. 70(3):332-346.
- Dockery DW, Pope CA, Xu X, Spengler JD, Ware JH, Fay ME, Ferris BGJ, Speizer FE. 1993. "An association between air pollution and mortality in six U.S. cities". *New England Journal of Medicine* 1993; 329: 1753-1759.
- Hubbell BJ, Hallberg A, McCubbin DR, Post E. 2005. Health-Related Benefits of Attaining the 8-Hr Ozone Standard. *Environmental Health Perspectives*. 113(1):73-82.
- Kunzli, N., Kaiser, R., Medina, S., Studnicka, M., Chanel, O., Filliger, P., Herry, M., Horak, Jr. F., Puybonnieux-Texier, V., Quenel, P., Schneider, J., Seethaler, R., Vergnaud J.C., and Sommer H. 2000. Public-health impact of outdoor and traffic-related air pollution: a European assessment [see comments]. *Lancet* 356:795-801.
- National Research Council (NRC). 2002. Estimating the Public Health Benefits of Proposed Air Pollution Regulations. Committee on Estimating the Health-Risk-Reduction Benefits of Proposed Air Pollution Regulations, Board on Environmental Studies and Toxicology. The National Academies Press. Washington, D.C. Available at: <http://www.nap.edu/catalog/10511.html>

- Northeast States for Coordinated Air Use Management (NESCAUM). 2008. Public Health Benefits of Reducing Ground-level Ozone and Fine Particulate Matter in the Northeast U.S., A Benefits Mapping and Analysis Program (BenMAP) Study. Available at:
http://www.nescaum.org/documents/benmap_report_1-16-08.pdf/
- Pope CA, 3rd, Thun MJ, Nmboodiri MM, Dockery DW, Evans JS, Speizer FE, Heath CW, Jr. 1995. "Particulate air pollution as a predictor of mortality in a prospective study of U.S. adults". *American Journal of Respiratory & Critical Care Medicine* 1995; 151: 669-674.
- Pope CA, Burnett RT, Thun MJ, Calle EE, Krewski D, Ito K, Thurston GD. 2002. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Journal of the American Medical Association (JAMA)* 2002; 287: 1132-1141.
- Schreiber E (Earth Tech) and Mahoney H (Abt Associates). 2007. Email communication from Mahoney to Schreiber containing the population file from PopGrid. November 16, 2007.
- U.S. Department of Energy (DOE). 2006. *Special Environmental Analysis, for Actions Taken under U.S. Department of Energy Emergency Orders Regarding Operation of the Potomac River Generating Station in Alexandria, Virginia*. Washington, DC. November 2006.
- U.S. Environmental Protection Agency (EPA). 1989. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*. EPA/540/1-89/002 .Office of Emergency and Remedial Response. Washington, DC. December 1989.
- U.S. Environmental Protection Agency (EPA). 2000. An SAB Report on EPA's White Paper Valuing the Benefits of Fatal Cancer Risk Reduction. Prepared by the Environmental Economics Advisory Committee (EEAC) of the Science Advisory Board, U.S. Environmental Protection Agency. Washington, DC. EPA-SAB-EEAC-00-013. July 27.
- U.S. Environmental Protection Agency (EPA). 2001. Review of the Draft Analytical Plan for EPA's Second Prospective Analysis -- Benefits and Costs of the Clean Air Act 1990-2020: An Advisory by the Advisory Council on Clean Air Compliance Analysis. Prepared a Special Panel of the Advisory Council on Clean Air Compliance Analysis of the Science Advisory Board, Washington, DC: U.S. Environmental Protection Agency. EPA-SAB-COUNCIL-ADV-01-004. September 24.

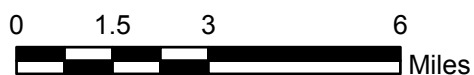
- U.S. Environmental Protection Agency (EPA). 2004. *Air Quality Criteria for Particulate Matter, Volumes I and II*. EPA/600/P-99/002bF. National Center for Environmental Assessment, Office of Research and Development. Research Triangle Park, NC. October 2004.
- U.S. Environmental Protection Agency (EPA). 2006a. *Regulatory Impact Analysis; National Ambient Air Quality Standards for Particle Pollutions*; Chapter 5, Benefit Analysis and Results. Assessment and Standards Division Office of Transportation and Air Quality. October 2006.
- U.S. Environmental Protection Agency (EPA). 2006b. *Provisional Assessment of Recent Studies on Health Effects of Particulate Matter Exposure*. EPA/600/R-06/063. National Center for Environmental Assessment, Office of Research and Development. Research Triangle Park, NC. July 2006.
- U.S. Environmental Protection Agency (EPA). 2007. *Regulatory Impact Analysis; Control of Hazardous Air Pollutants from Mobile Sources*; Chapter 12, Cost-Benefit Analysis. Assessment and Standards Division Office of Transportation and Air Quality. EPA420-R07-002. February 2007.
- Vingarzan, R. 2004. *Ambient Particulate Matter Concentrations in Canada and Background Levels*. Environment Canada, Environmental Conservation Branch, Aquatic and Atmospheric Sciences Division, #201-401. Vancouver, British Columbia.
- Virginia Department of Environmental Quality (VDEQ). 2007. "Alexandria Summary" of Ambient Air Quality. Provided to Maureen Barrett of Aero Engineering from Mike Kiss of VDEQ. October 2, 2007.

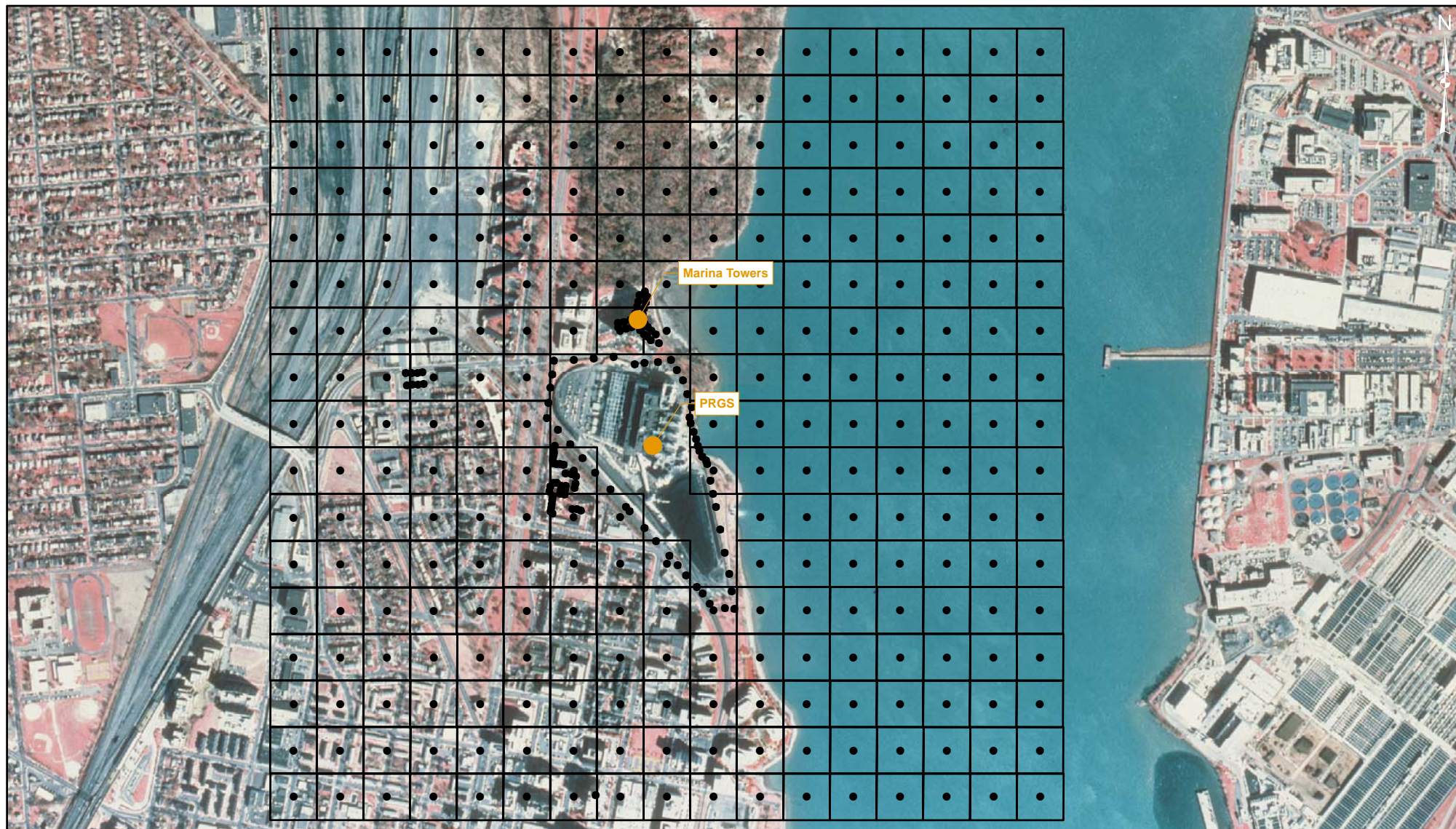
FIGURES



Legend

- Points of Interest
- 800-Meter Grid Boundary
- County Boundary



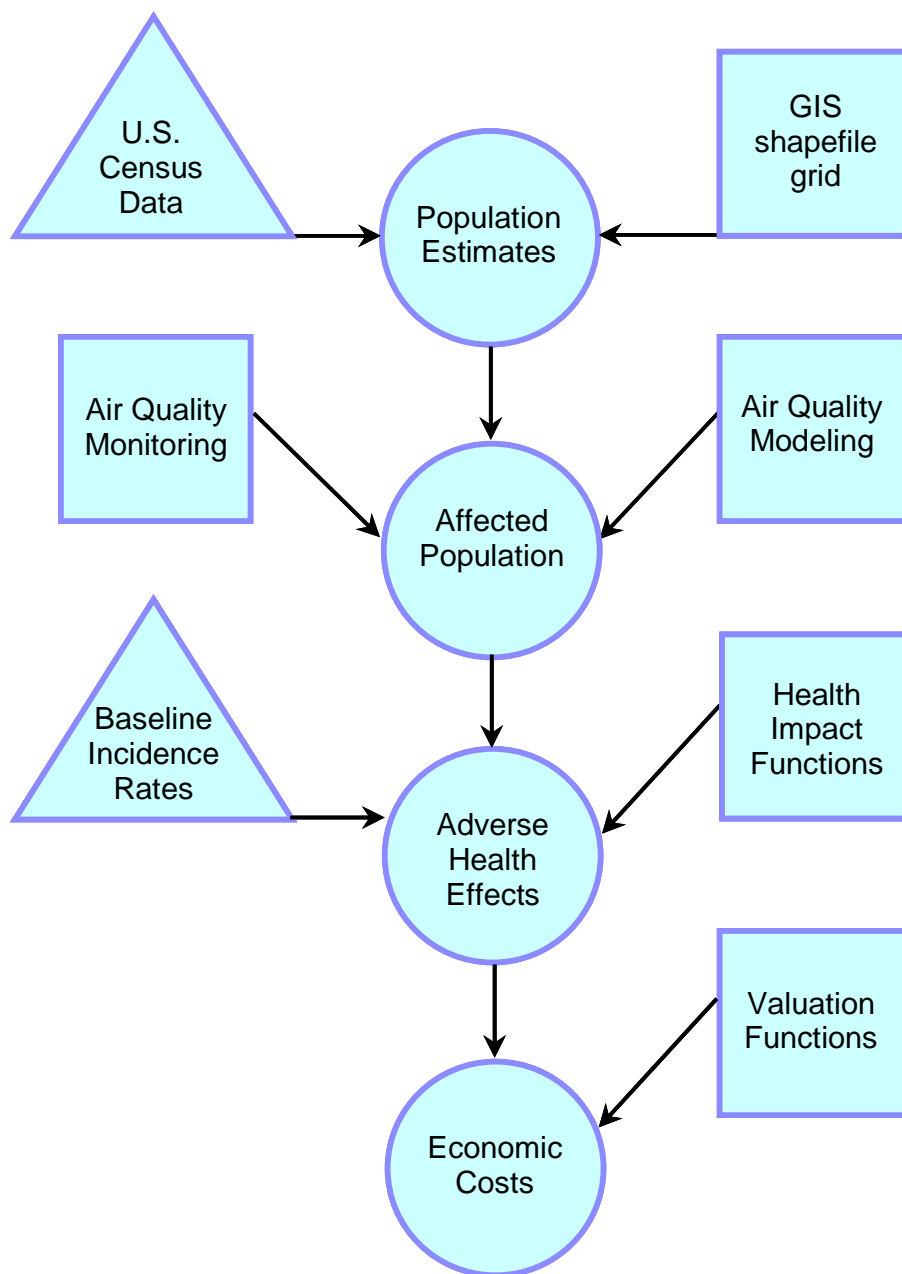


Legend

- Points of Interest
- Receptor Points
- 800-Meter Grid Boundary

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Figure 2
800-Meter Grid Boundary
With Receptor Points



Legend



BenMAP Input



Result from Inputs



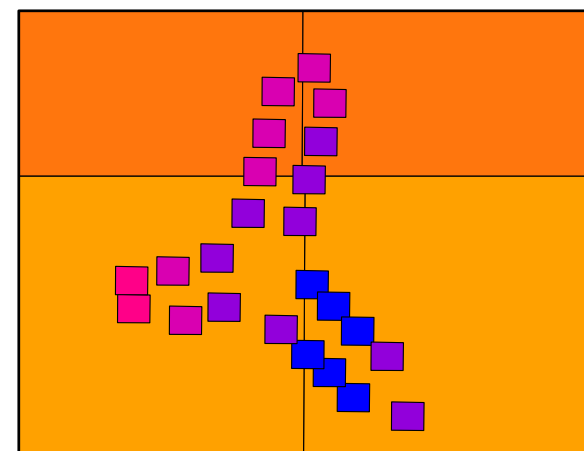
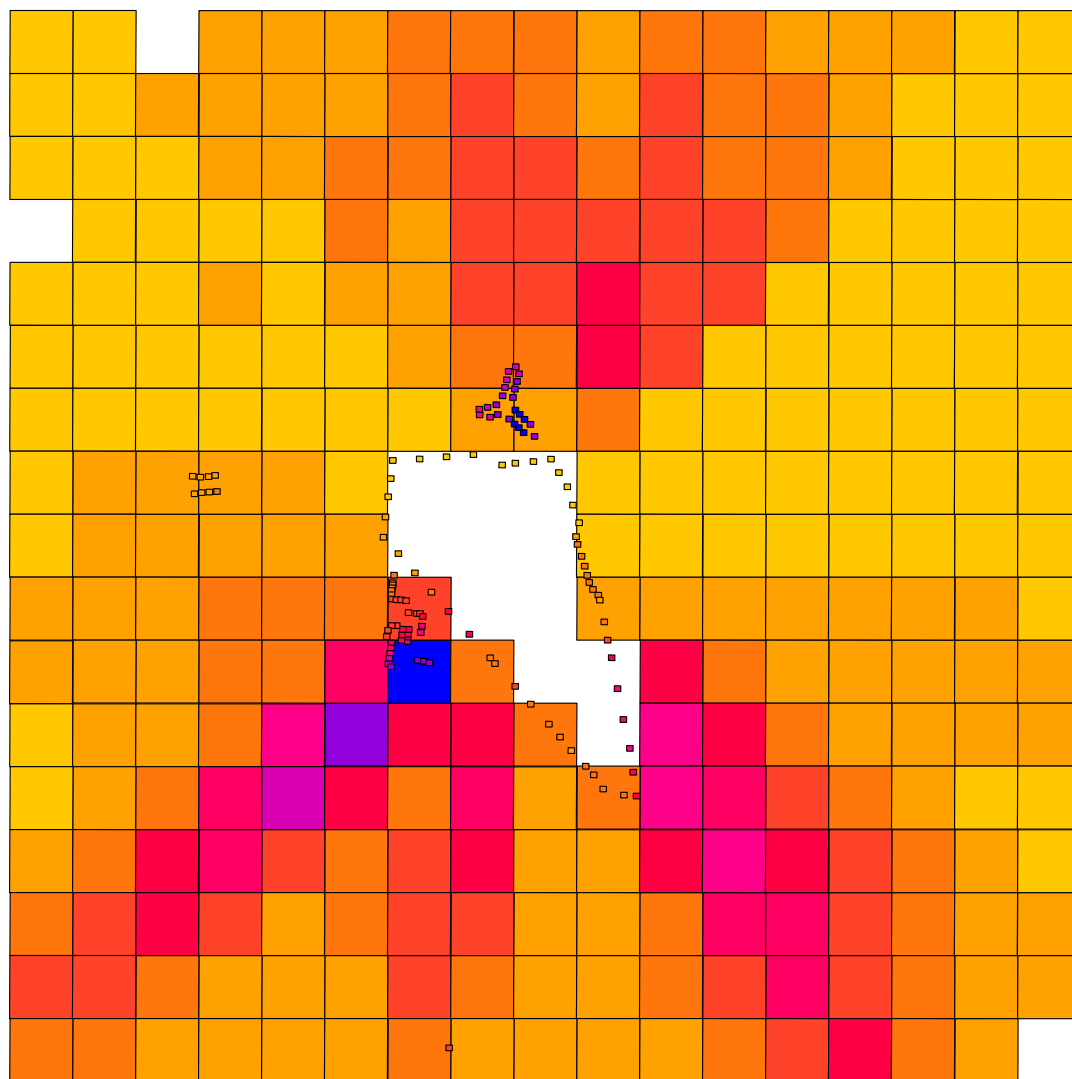
User Input Choice



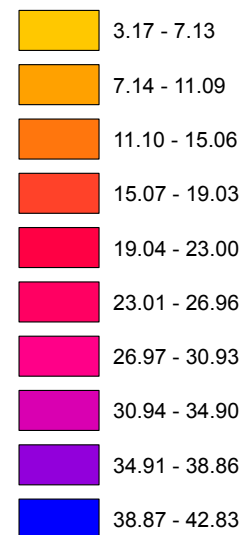
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Figure 3

BenMAP Custom Analysis
Approach

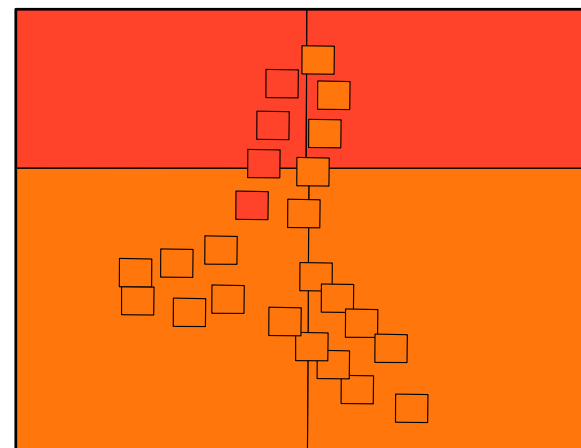
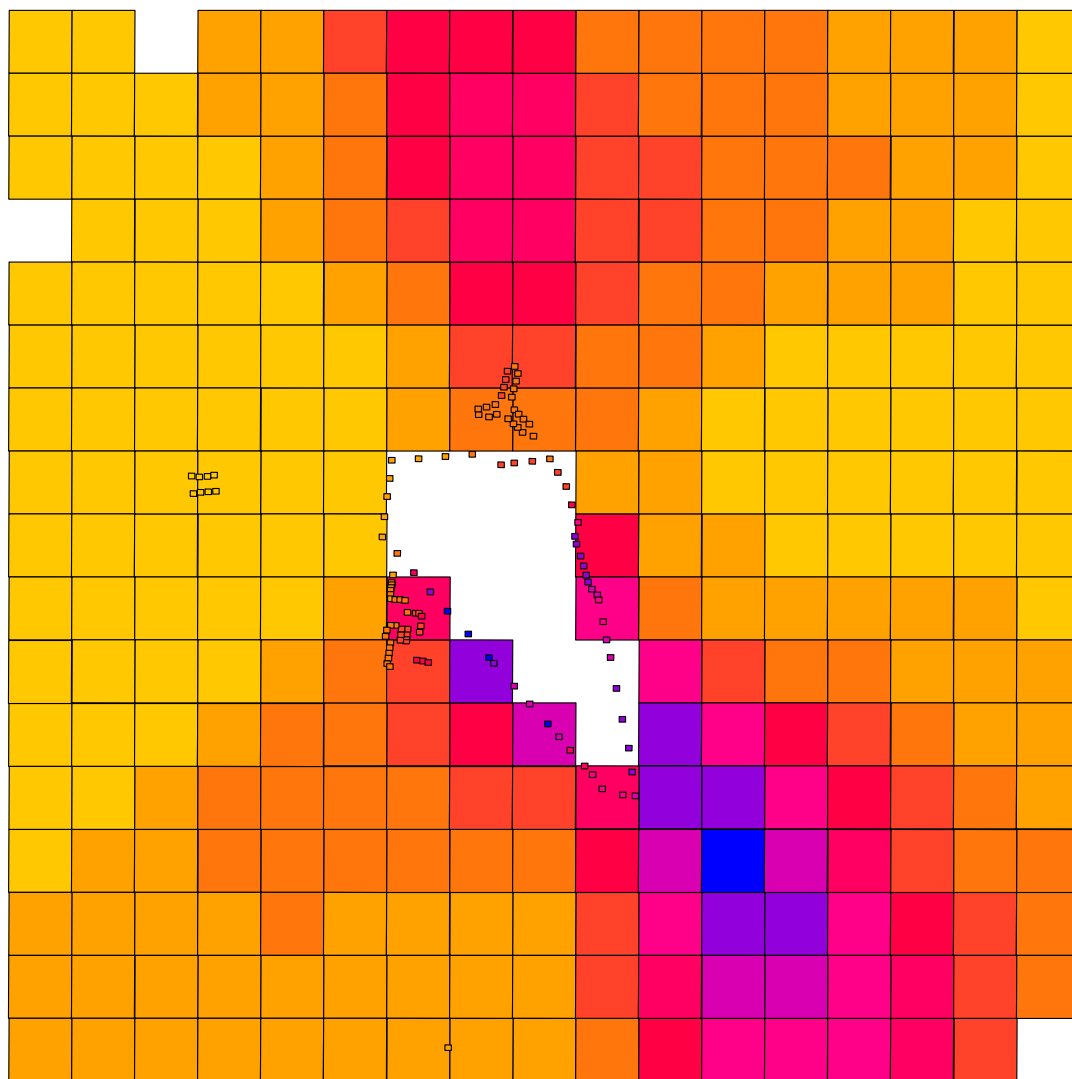


Legend

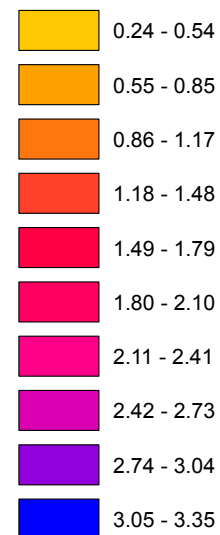


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Figure 4
Modeled PRGS 24 Hour Max Contributions to
Ambient Air Concentrations of PM_{2.5}



Legend



TABLES

Table 1
Assumptions Used for Air Modeling Conducted by the U.S. DOE and the City of Alexandria to Estimate Premature Mortality
and Health Effects from PM_{2.5} Contributions by the Potomac River Generating Station
Comments to the Draft SOP, Dated 12/21/2007, 2-Stack Version

	US DOE SEA-04 (Nov. 2006) Assuming Five-Stack Operation	City of Alexandria's Analysis Assuming Two-Stack Operation
Region Studied	App. 10 x 10 km grid	800 x 800 m receptor grid
Pollutants Used	Primary PM _{2.5} with an additional sulfate component (assuming conversion of plant's SO ₂ impact at a 0.07 conversion rate on 24-hour basis). ¹	Primary PM _{2.5} with an additional sulfate component (assuming conversion of plant's SO ₂ impact at a 0.07 conversion rate on 24-hour basis). ²
Emission Rates Assumed	0.019 lb per MMBtu for primary PM _{2.5} (DOE adjusted PM _{2.5} impacts to include an SO ₂ component, which is presumed to be 7% of SO ₂ impacts for each day and receptor calculated using daily-varying SO ₂ emission rate.)	0.055 lb per MMBtu for PM _{2.5} , including PM _{2.5} (primary) at 0.030 lb per MMBtu and 7% of SO ₂ rate of 0.35 lb per MMBtu.
Operational Output	Maximum allowed under 'Operations under the Order' and 'Potential Extension of the Order.' Assumed 3-base load boilers operating for 9 hours on and 15 hours off. Fugitive source emissions were scaled to reflect three-boiler operation.	Assumed operational scenario '1D' with all five boilers running at mid-load, and fugitive source emissions at 100% of maximum potential. ³
Time Period Used in Health Effects Calculations	Annualized, grid-averaged value.	Maximum daily estimate and the annualized, grid-averaged value.
Downwash Dimensions	US EPA's BPIP-PRIME	Equivalent Building Dimensions
Approximate Maximum Daily Impact of Total PM _{2.5} among all Receptors for Operations Studied ⁴	<p>Maximum Total PM_{2.5} (24-hour) = 79 µg/m³ (PM_{2.5} concentration <u>without</u> the addition of sulfate contribution).</p> <p>Grid-averaged values includes sulfate contribution at a rate of 7% of SO₂ daily concentrations.</p>	<p>Maximum Total PM_{2.5} (24-hour) = 76.9 µg/m³ (<u>with</u> the addition of sulfate contribution).</p> <p>Primary PM_{2.5} daily concentrations at all receptors include a sulfate component at a rate of 7% of SO₂ daily concentrations.</p>

Notes:

¹ US DOE used 0.019 pounds per MMBtu and scaled this by a factor of 0.76 and then added 7% of the 24-hour maximum SO₂ concentration allowed under the order of 314 mg/m³ to estimate PM_{2.5} primary emissions from PM₁₀ primary emissions from the stack source.

² Alexandria used a rate of 0.03 pounds per MMBtu (with no scaling) and added 7% X 0.035 (for SO₂ conversion) for a PM_{2.5} value of 0.055 pounds per MMBtu.

³ This scenario represents the highest operating potential allowed under the permit, generating the highest PM_{2.5} emissions and is used to represent the "worst-case" scenario.

⁴ These values represent the highest impacts, which occur at the Marina Towers and not at ground level. These values include the PRGS modeled concentrations in addition to 35.7 µg/m³ background concentration used for DOE's assessment and a 34.1 µg/m³ background concentration used by the City of Alexandria.

Table 2
BenMAP Incidence Configuration and Pooling Settings Used to Estimate
Health Effects from PM_{2.5} Contributions by the Potomac River Generating Station

Endpoint	Pollutant	Epidemiological Study	Age Range	Study Threshold Value (µg)	Incidence Dataset	Pooling Approach ¹
Mortality						None
Premature mortality - all cause	PM _{2.5}	Pope et al. (2002)	30-99	7.5 10	2005 Mortality Incidence	Random / Fixed Effects
Infant mortality - all cause	PM _{2.5}	Woodruff et al. (1997)	< 1 year	7.5 10	2005 Mortality Incidence	Random / Fixed Effects
Chronic Illness						
Chronic bronchitis	PM _{2.5}	Abbey et al. (1995)	27-99	7.5 10	2000 Incidence and Prevalence	Random / Fixed Effects
Nonfatal heart attacks	PM _{2.5}	Peters et al. (2001)	18-99	10	2000 Incidence and Prevalence	Random / Fixed Effects
Hospital Admissions						
Respiratory						None
- Chronic lung disease	PM _{2.5}	Moolgavkar (2003) Ito (2003)	65-99	10	2000 Incidence and Prevalence	Random / Fixed Effects
- Chronic lung disease (less Asthma)	PM _{2.5}	Moolgavkar (2000)	18-64	10	2000 Incidence and Prevalence	NA
- Asthma	PM _{2.5}	Sheppard (2003)	0-64	10	2000 Incidence and Prevalence	NA
- Pneumonia	PM _{2.5}	Ito (2003)	65-99	10	2000 Incidence and Prevalence	NA
Cardiovascular						
- All cardiovascular	PM _{2.5}	Moolgavkar (2000)	18-64	10	2000 Incidence and Prevalence	NA
- Ischemic heart disease		Moolgavkar (2003) Ito (2003)	65-99	10	2000 Incidence and Prevalence	Random / Fixed Effects
- Dysrhythmia		Ito (2003)				
- Congestive heart failure		Ito (2003)				
Asthma-related ER visits	PM _{2.5}	Norris et al. (1999)	0-17	10	2000 Incidence and Prevalence	NA
Other Health Endpoints						
Acute bronchitis	PM _{2.5}	Dockery et al. (1996)	8-12	7.5 10	2000 Incidence and Prevalence	Random / Fixed Effects
Upper respiratory symptoms	PM _{2.5}	Pope et al. (1991)	9-11	10	None	NA
Lower respiratory symptoms	PM _{2.5}	Schwartz and Neas (2000)	7-14	10	None	NA
Asthma exacerbations						
- Cough	PM _{2.5}	Ostro et al. (2001) Vedal et al. (1998) Ostro et al. (2001) Ostro et al. (2001)	6-18	10	None	Random / Fixed Effects ²
- Wheeze						
- Shortness of breath						
Work loss days	PM _{2.5}	Ostro (1987)	18-64	10	2000 Incidence and Prevalence	NA
Minor restricted activity days	PM _{2.5}	Ostro and Rothschild (1989)	18-64	10	None	NA

Notes:

NA = Not Available

¹ Random/Fixed Effects Pooling firsts tests if random weights should be used. If not, BenMAP uses fixed effects weights. If yes, the weights take into account both the variance within each set of results and the variance between sets of results. Results are then combined according to the chosen Advanced Pooling Method.

² Cough studies Ostro et al. (2001) and Vedal et al. (1998) were first pooled using Random/Fixed Effects before pooling all Asthma Exacerbations endpoints.

- A population year of 2008 was selected for all estimations.
- Default advanced pooling method was set to "use exact weights for Monte Carlo" for each configuration.
- Default Monte Carlo Iterations were set to "5000" for each configuration.
- Advanced pooling method for Random/Fixed Effects was set to "Round weights to two digits" for each configuration.
- Monte Carlo Iterations for Random/Fixed Effects were set to "5000" for each configuration.

Table 3
BenMAP Valuation Configuration and Pooling Settings Used to Estimate
Health Effects from PM_{2.5} Contributions by the Potomac River Generating Station

Endpoint	Pollutant	Epidemiological Study	Age Range	Valuation Method ^{1,2,3}	Pooling Approach ⁴
<i>Mortality</i>					None
Premature mortality - all cause	PM _{2.5}	Pope et al. (2002)	30-99	VSL, based on 26 value-of-life studies; 0-99	NA
Premature mortality - all cause	PM _{2.5}	Woodruff et al. (1997)	< 1 year	VSL, based on 26 value-of-life studies; 0-99	NA
<i>Chronic Illness</i>					
Chronic bronchitis	PM _{2.5}	Abbey et al. (1995)	27-99	WTP: average severity; 30-99	NA
Nonfatal heart attacks	PM _{2.5}	Peters et al. (2001)	18-99	COI: 5 yrs med, 5 yrs wages, 3% DR, Russell (1998); 0-99 COI: 10 yrs med, 5 yrs wages, 3% DR, Eisenstein (2001); 0-99	Random / Fixed Effects
<i>Hospital Admissions</i>					
<i>Respiratory</i>					None
- Chronic lung disease	PM _{2.5}	Moolgavkar (2003) Ito (2003)	65-99	COI: med costs + wage loss; 65-99	NA
- Chronic lung disease (less Asthma)	PM _{2.5}	Moolgavkar (2000)	18-64	COI: med costs + wage loss; 20-64	NA
- Asthma	PM _{2.5}	Sheppard (2003)	0-64	COI: med costs + wage loss; 0-64	NA
- Pneumonia	PM _{2.5}	Ito (2003)	65-99	COI: med costs + wage loss; 65-99	NA
<i>Cardiovascular</i>					
- All cardiovascular	PM _{2.5}	Moolgavkar (2000)	18-64	COI: med costs + wage loss; 20-64	NA
		Moolgavkar (2003)	65-99	COI: med costs + wage loss; 65-99	Random / Fixed Effects
- Ischemic heart disease		Ito (2003)		COI: med costs + wage loss; 65-99	
- Dysrhythmia		Ito (2003)		COI: med costs + wage loss; 0-99	
- Congestive heart failure		Ito (2003)		COI: med costs + wage loss; 65-99	
Asthma-related ER visits	PM _{2.5}	Norris et al. (1999)	0-17	COI: Stanford et al. (1999); 0-99	NA
<i>Other Health Endpoints</i>					
Acute bronchitis	PM _{2.5}	Dockery et al. (1996)	8-12	WTP: 1 day illness, CV studies; 0-17	NA
Upper respiratory symptoms	PM _{2.5}	Pope et al. (1991)	9-11	WTP: 1 day, CV studies; 0-17	NA
Lower respiratory symptoms	PM _{2.5}	Schwartz and Neas (2000)	7-14	WTP: 1 day, CV studies; 0-17	NA
<i>Asthma exacerbations</i>					
- Cough	PM _{2.5}	Ostro et al. (2001) Vedal et al. (1998)	6-18	<u>Cough, Wheeze & Shortness of Breath:</u> WTP: 1-symptom day, Dickie and Ulery (2002); 0-17 WTP: 1-symptom day, Dickie and Ulery (2002); 18-99	Random / Fixed Effects
- Wheeze		Ostro et al. (2001)			
- Shortness of breath		Ostro et al. (2001)			
		Ostro et al. (2001)			
Work loss days	PM _{2.5}	Ostro (1987)	18-64	Median daily wage, county-specific; 18-65	NA
Minor restricted activity days	PM _{2.5}	Ostro and Rothschild (1989)	18-64	WTP: 1 day, CV studies; 18-99	NA

Notes:

NA = Not Available

¹ VSL = value of a statistical life; economic value given to the elimination of one premature death.

² WTP = willingness of individuals to pay for a good.

³ COI = cost of illness including the direct medical costs and lost earnings associated with illness.

⁴ Random/Fixed Effects Pooling firsts tests if random weights should be used. If not, BenMAP uses fixed effects weights. If yes, the weights take into account both the variance within each set of results and the variance between sets of results. Results are then combined according to the chosen Advanced Pooling Method.

- All valuation estimations were made in 2000 dollars.

- Advanced pooling method for Random/Fixed Effects was set to "Round weights to two digits" for each configuration.

- Monte Carlo Iterations for Random/Fixed Effects were set to "5000" for each configuration.

- Valuation variable dataset was set to "EPA Standard Variables" for each configuration.

- Calculated final incidence and valuation estimations using "Pooled Incidence and Pooled Valuation" results.

Table 4
Particulate Matter Concentration-Response (C-R) Functions for Health Effects Evaluated for the Potomac River Generating Station

Endpoint Group	Endpoint	Pollutant	Author	Year	Location	Age	Race	Threshold	Odds Ratio ¹	Relative Risk ¹	95% CI ¹	Coefficient ²	Std Error ²	Functional Form ¹	Notes
Acute Bronchitis	Acute Bronchitis	PM _{2.5}	Dockery et al.	1996	24 Communities	8-12	All	7.5 ug	1.50	----	0.91 - 2.47	0.0307	0.0193	Logistic	
Acute Bronchitis	Acute Bronchitis	PM _{2.5}	Dockery et al.	1996	24 Communities	8-12	All	10 ug	1.50	----	0.91 - 2.47	0.03788	0.02381	Logistic	
Asthma Exacerbations	Cough	PM _{2.5}	Ostro et al.	2001	Los Angeles, CA	6-18	Black	10 ug	1.03	----	0.98 - 1.07	0.00101	0.00077	Logistic	Day with symptoms
Asthma Exacerbations	Cough	PM ₁₀	Vedal et al.	1998	Vancouver, CAN	6-18	All	10 ug	----	----	0-16% ^a	0.00806	0.00397	Logistic	
Asthma Exacerbations	Shortness of Breath	PM _{2.5}	Ostro et al.	2001	Los Angeles, CA	6-18	Black	10 ug	1.08	----	1.00 - 1.17	0.00264	0.00138	Logistic	Day with symptoms
Asthma Exacerbations	Wheeze	PM _{2.5}	Ostro et al.	2001	Los Angeles, CA	6-18	Black	10 ug	1.06	----	1.01 - 1.11	0.00199	0.00082	Logistic	Day with symptoms
Emergency Room Visits	Asthma	PM _{2.5}	Norris et al.	1999	Seattle, WA	0-17	All	10 ug	----	1.15	1.08 - 1.23	0.01851	0.00465	Log-linear	
Chronic Bronchitis	Chronic Bronchitis	PM _{2.5}	Abbey et al.	1995	SF, SD, South Coast Air Basin	27-99	All	7.5 ug	----	1.81	0.98 - 3.25	0.0137	0.0068	Logistic	
Chronic Bronchitis	Chronic Bronchitis	PM _{2.5}	Abbey et al.	1995	SF, SD, South Coast Air Basin	27-99	All	10 ug	----	1.81	0.98 - 3.26	0.0137	0.0068	Logistic	
Hospital Admissions: Cardiovascular	All Cardiovascular (less myocardial infarctions)	PM _{2.5}	Moolgavkar	2000	Los Angeles, CA	18-64	All	10 ug	----	----	----	0.0015 ^b	0.000369 ^b	Log-linear	
Hospital Admissions: Cardiovascular	All Cardiovascular (less myocardial infarctions)	PM _{2.5}	Moolgavkar	2003	Los Angeles, CA	65-99	All	10 ug	----	----	----	0.001694 ^c	0.000369 ^c	Log-linear	Reanalysis of Moolgavkar 2000a
Hospital Admissions: Cardiovascular	Ischemic Heart Disease (less myocardial infarctions)	PM _{2.5}	Ito	2003	Detroit, MI	65-99	All	10 ug	----	1.05	0.97 - 1.14	0.00161	0.00131	Log-linear	Reanalysis of Lippman et al., 2000
Hospital Admissions: Cardiovascular	Dysrhythmia	PM _{2.5}	Ito	2003	Detroit, MI	65-99	All	10 ug	----	1.05	0.91 - 1.21	0.00141	0.00228	Log-linear	Reanalysis of Lippman et al., 2000
Hospital Admissions: Cardiovascular	Congestive Heart Failure	PM _{2.5}	Ito	2003	Detroit, MI	65-99	All	10 ug	----	1.12	1.02 - 1.22	0.00345	0.00145	Log-linear	Reanalysis of Lippman et al., 2000
Hospital Admissions: Respiratory	Chronic Lung Disease	PM _{2.5}	Ito	2003	Detroit, MI	65-99	All	10 ug	----	1.04	0.90 - 1.21	0.00132	0.00206	Log-linear	Reanalysis of Lippman et al., 2000
Hospital Admissions: Respiratory	Chronic Lung Disease	PM _{2.5}	Moolgavkar	2003	Los Angeles, CA	65-99	All	10 ug	----	----	----	0.001974 ^d	0.00056 ^d	Log-linear	Reanalysis of Moolgavkar 2000b
Hospital Admissions: Respiratory	Chronic Lung Disease (less Asthma)	PM _{2.5}	Moolgavkar	2000	Los Angeles, CA	18-64	All	10 ug	----	----	----	0.002352 ^e	0.000782 ^e	Log-linear	
Hospital Admissions: Respiratory	Pneumonia	PM _{2.5}	Ito	2003	Detroit, MI	65-99	All	10 ug	----	1.15	-1.03 - 1.3	0.00448	0.00187	Log-linear	Reanalysis of Lippman et al., 2000
Hospital Admissions: Respiratory	Asthma	PM _{2.5}	Sheppard et al.	2003	Seattle, WA	0-64	All	10 ug	----	1.03	1.01 - 1.06	0.00392	0.00123	Log-linear	Reanalysis of Sheppard et al., 1999
Lower Respiratory Symptoms	Lower Respiratory Symptoms	PM _{2.5}	Schwartz and Neas	2000	6 Cities	7-14	All	10 ug	1.33	----	1.11 - 1.58	0.0197	0.00622	Logistic	
Mortality	Mortality - all cause	PM _{2.5}	Pope et al.	2002	51 Cities	30-99	All	7.5 ug	----	1.06	1.02 - 1.11	0.00583	0.00216	Log-linear	Average of '79-'83 and '99-'00 air data
Mortality	Mortality - all cause	PM _{2.5}	Pope et al.	2002	51 Cities	30-99	All	10 ug	----	1.06	1.02 - 1.11	0.00656	0.00243	Log-linear	Average of '79-'83 and '99-'00 air data
Mortality	Mortality - all cause	PM ₁₀	Woodruff et al.	1997	86 Cities	< 1 year	All	7.5 ug	1.04	----	1.02 - 1.07	0.00392	0.00122	Logistic	
Mortality	Mortality - all cause	PM ₁₀	Woodruff et al.	1997	86 Cities	< 1 year	All	10 ug	1.04	----	1.02 - 1.07	0.00392	0.00122	Logistic	
Acute Respiratory Symptoms	Minor Restricted Activity Days	PM _{2.5}	Ostro and Rothschild	1989	Nationwide	18-64	All	10 ug	----	----	----	0.00741 ^f	0.0007 ^f	Log-linear	
Acute Myocardial Infarction	Nonfatal	PM _{2.5}	Peters et al.	2001	Boston, MA	18-99	All	10 ug	1.62	----	1.13 - 2.34	0.0332	0.00928	Logistic	
Upper Respiratory Symptoms	Upper Respiratory Symptoms	PM ₁₀	Pope et al.	1991	Utah Valley, UT	9-11	All	10 ug	----	----	----	0.0036	0.0015	Logistic	
Work Loss Days	Work Loss Days	PM _{2.5}	Ostro	1987	Nationwide	18-64	All	10 ug	----	----	----	0.0046 ^g	0.00036 ^g	Log-linear	

Notes:

All epidemiological studies chosen for this analysis used study populations comprised of males and females.

¹ Data from BenMAP Technical Appendix F (Abt Associates 2005).

² Values were taken from Audit Trail Reports generated from the .aprv files of each endpoint using BenMAP.

^a 95% CI of the odds which were 8%.

^b Coefficient and standard error were calculated from an estimated percent change of 1.4⁷⁰ and t-statistic of 4.1.

^c Coefficient and standard error were calculated from an estimated percent change of 1.58⁶⁸ and t-statistic of 4.59.

^d Coefficient and standard error were calculated from an estimated percent change of 1.85⁴⁸ and t-statistic of 3.53.

^e Coefficient and standard error were calculated from an estimated percent change of 2.0⁵⁷ and t-statistic of 2.2.

^f BenMAP used the results from the two-pollution model to develop separate coefficients for each year in the analysis, and then combined them for use in this analysis.

^g The coefficient used in the C-R function is a weighted average of the coefficients in Ostro (1987, Table III) using the inverse of the variance as the weight.

Table 5
Costs Associated the City of Alexandria's Evaluation of the Maximum 24 Hour Mean
Concentration-Related Incidence of Health Effects for the 800 Meter Grid around the PRGS
Comments to the Draft SOP, Dated 12/21/2007, 2-Stack Version

Health Effect	Study Population (years)	Epidemiological Study	Annual Predicted Cases	Total Annual Costs in 2000\$	Direct Costs U.S. 2007\$ by Case ²	Direct Costs Totals \$2007 ³
Mortality						
Premature mortality	30-99	Pope et al. (2002)	4.47	28,224,625	7,651,463	34,236,470
- all cause						
Infant Mortality	<1 year	Woodruff et al. (1997)	0.01	56,887	7,582,909	69,004
- all cause						
Chronic Illness						
Chronic bronchitis	27-99	Abbey et al. (1995)	4.30	1,454,210	409,965	1,763,957
Nonfatal heart attacks	18-99	Peters et al. (2001)	7.16	251,214	42,549	304,722
Hospital Admissions						
Respiratory						
- Chronic lung disease ⁴	65-99	Moolgavkar (2003) Ito (2003)	0.48	8,990	22,777	10,905
- Chronic lung disease (less Asthma)	18-64	Moolgavkar (2000)	0.36	4,573	15,263	5,546
- Asthma	0-64	Sheppard (2003)	0.67	5,349	9,648	6,489
- Pneumonia	65-99	Ito (2003)	1.47	26,769	22,125	32,471
Cardiovascular						
- all cardiovascular ⁵		Moolgavkar (2003)				
Ischemic heart disease	65-99	Ito (2003)	0.85	18,353	26,056	22,262
Dysrhythmia		Ito (2003)				
Congestive heart failure		Ito (2003)				
- all cardiovascular	20-64	Moolgavkar (2000)	1.56	35,778	27,909	43,398
Asthma-related ER visits	0-17	Norris et al. (1999)	3.93	1,023	316	1,241
Other Health Endpoints						
Acute bronchitis	8-12	Dockery et al. (1996)	4.20	249	72	302
Upper respiratory symptoms	9-11	Pope et al. (1991)	55.21	1,444	32	1,752
Lower respiratory symptoms	7-14	Schwartz and Neas (2000)	55.96	879	19	1,066
Asthma exacerbations⁶						
- Cough		Ostro et al. (2001)				
- Wheeze	6-18	Vedal et al. (1998)	58.57	4,311	89	5,230
- Shortness of breath		Ostro et al. (2001)				
Work loss days	18-64	Ostro (1987)	1075.21	183,762	207	222,904
Minor restricted activity days	18-64	Ostro and Rothschild (1989)	5910.78	298,837	61	362,489
Total Direct Costs 2007 Dollars						37,090,209

Total Estimated, Actual Direct Costs from 2007 to 2037 = \$1,854,609,764 ⁷

Total Estimated, Net Present Value, Direct Costs from 2007 to 2037 = \$726,968,089 ⁸

Notes:

¹ PRGS - Potomac River Generating Station in Alexandria, VA.

² U.S. Dollars were adjusted to 2007 values by applying the U.S. Bureau of Labor Statistics inflator of 1.213 from the Consumer Price Index for all urban households.

³ Multiplies the direct costs in 2007\$ by the number of cases.

⁴ Study results were pooled to provide these estimates. Chronic lung disease studies Moolgavkar (2003) and Ito (2003) were pooled using Random / Fixed Effects.

⁵ Study results were pooled to provide these estimates. Studies with study populations of 65-99 years (all Ito [2003] studies and Moolgavkar [2003]) were pooled together using Random / Fixed Effects.

⁶ Study results were pooled to provide these estimates. Asthma exacerbation cough studies Ostro et al. (2001) and Vedal et al. (1998) were first pooled together and then those results were pooled with wheeze and shortness of breath data.

⁷ Based on 2007 dollars inflated at an assumed annual rate of three percent (3%) each year for the 30 year period.

⁸ Net Present Value Costs represent costs in 2007 dollars and are estimated by multiplying the total yearly cost by a present worth factor of 19.6 which reflects a discount rate of three percent (3%).

Table 6
Costs Associated the City of Alexandria's Evaluation of the Annual Average Concentration-Related
Incidence of Health Effects for the 800 Meter Grid around the PRGS¹
Comments to the Draft SOP, Dated 12/21/2007, 2-Stack Version

Health Effect	Study Population (years)	Epidemiological Study	Annual Predicted Cases	Total Annual Cost in 2000\$	Direct Costs U.S. 2007\$ by Case ²	Direct Costs Totals \$2007 ³
Mortality						
Premature mortality	30-99	Pope et al. (2002)	0.88	5,528,234	7,646,234	6,705,747
- all cause						
Infant mortality	<1 year	Woodruff et al. (1997)	0.0013	7,136	6,658,051	8,655
- all cause						
Chronic Illness						
Chronic bronchitis	27-99	Abbey et al. (1995)	0.82	278,490	409,565	337,809
Nonfatal heart attacks	18-99	Peters et al. (2001)	1.65	59,948	44,183	72,717
Hospital Admissions						
Respiratory						
- Chronic lung disease ⁴	65-99	Moolgavkar (2003)	0.07	931	16,138	1,130
		Ito (2003)				
- Chronic lung disease (less Asthma)	18-64	Moolgavkar (2000)	0.06	710	14,359	862
- Asthma	0-64	Sheppard (2003)	0.11	845	9,323	1,026
- Pneumonia	65-99	Ito (2003)	0.23	4,234	22,330	5,136
Cardiovascular						
- all cardiovascular ⁵		Moolgavkar (2003)				
Ischemic heart disease	65-99	Ito (2003)	0.13	3,377	31,511	4,096
Dysrhythmia		Ito (2003)				
Congestive heart failure		Ito (2003)				
- all cardiovascular	20-64	Moolgavkar (2000)	0.24	5,482	27,706	6,649
Asthma-related ER visits	0-17	Norris et al. (1999)	0.75	194	314	236
Other Health Endpoints						
Acute bronchitis	8-12	Dockery et al. (1996)	1.13	67	72	81
Upper respiratory symptoms	9-11	Pope et al. (1991)	8.22	215	32	261
Lower respiratory symptoms	7-14	Schwartz and Neas (2000)	10.81	170	19	206
Asthma exacerbations⁶						
- Cough		Ostro et al. (2001)				
	6-18	Vedal et al. (1998)	7.84	577	89	700
- Wheeze		Ostro et al. (2001)				
- Shortness of breath		Ostro et al. (2001)				
Work loss days	18-64	Ostro (1987)	172.27	29,443	207	35,714
Minor restricted activity days	18-64	Ostro and Rothschild (1989)	983.22	49,698	61	60,283
Total Direct Costs 2007 Dollars						7,241,308

Total Estimated, Actual Direct Costs from 2007 to 2037 = \$362,084,799⁷

Total Estimated, Net Present Value, Direct Costs from 2007 to 2037 = \$141,929,639⁸

Notes:

¹ PRGS - Potomac River Generating Station in Alexandria, VA.

² U.S. Dollars were adjusted to 2007 values by applying the U.S. Bureau of Labor Statistics inflator of 1.213 from the Consumer Price Index for all urban households.

³ Multiplies the direct costs in 2007\$ by the number of cases.

⁴ Study results were pooled to provide these estimates. Chronic lung disease studies Moolgavkar (2003) and Ito (2003) were pooled using Random / Fixed Effects.

⁵ Study results were pooled to provide these estimates. Studies with study populations of 65-99 years (all Ito [2003] studies and Moolgavkar [2003]) were pooled together using Random / Fixed Effects.

⁶ Study results were pooled to provide these estimates. Asthma exacerbation cough studies Ostro et al. (2001) and Vedal et al. (1998) were first pooled together and then those results were pooled with wheeze and shortness of breath data.

⁷ Based on 2007 dollars inflated at an assumed annual rate of three percent (3%) each year for the 30 year period.

⁸ Net Present Value Costs represent costs in 2007 dollars and are estimated by multiplying the total yearly cost by a present worth factor of 19.6 which reflects a discount rate of three percent (3%).

Table 7
Costs Associated with the Expected Incidence of Health Effects for the Eastern United States
Based on the U.S. DOE Modeling and Health Assessment (DOE 20061)
Comments to the Draft SOP, Dated 12/21/2007, 2-Stack Version

Health Effect ¹	Valuation Source ²	Annual Predicted Cases (DOE 2006) ¹	Direct Costs US 2000\$ by Case ²	Direct Costs US 2007\$ by Case ³	Direct Cost Totals \$2007 ⁴
Premature mortality (adults, 30 and over)	Viscusi 1992	23	6,300,000	7,644,000	175,812,000
Infant mortality (infants less than one year)	Viscusi 1992	0.05	6,300,000	7,644,000	382,200
Chronic bronchitis (adults, 26 and over)	Viscusi et al. 1991	13	340,000	412,533	5,362,929
Non-fatal myocardial infarctions (adults, 18 and older)	Eisenstein 2001	31	49,651-126,602	62,499	1,937,475
Hospital admissions - Respiratory (adults, 20 and older)	Agency for Healthcare Research and Quality, 2000	8	12,000-18,000	14,560	116,480
Hospital admissions - Cardiovascular (adults, 20 and older)	Agency for Healthcare Research and Quality, 2000	7	21,000-23,000	25,480	178,360
Emergency room visits for asthma (18 and younger)	EPA 2006	19	300	364	6,916
Acute bronchitis (children, 8-12)	EPA 2006	29	360	437	12,673
Asthma exacerbations (asthmatic children, 6-18)	EPA 2006	440	40	49	21,560
Lower respiratory symptoms (children, 7-14)	EPA 2006	349	15-50	18	6,282
Upper respiratory symptoms (asthmatic children, 9-11)	EPA 2006	267	15-50	18	4,806
Work loss days (adults, 18-65)	EPA 2006	2,488	100	121	301,048
Minor restricted activity days (adults, age 18-65)	Ostro and Rothschild (1989)	14,823	50	61	904,203
Total Direct Costs 2007 Dollars					185,046,932

Total Estimated, Actual Direct Costs from 2007 to 2037 = \$9,252,842,1821⁵

Total Estimated, Net Present Value, Direct Costs from 2007 to 2037 = \$3,626,919,865⁶

Notes:

¹ Effects presented in the Special Environmental Analysis for Actions Taken under U.S. Department of Energy Emergency Orders Regarding Operation of the Potomac River Generating Station in Alexandria, Virginia (U.S. Department of Energy November 2006). The number of cases were based on emissions modeled for the PRGS operating period from December 2006 to December 2007 for a population of the Eastern United States.

² Valuation sources used are those used by the EPA to value health effects in the Regulatory Impact Analysis; Control of Hazardous Air Pollutants from Mobile Sources; Document number EPA 420-R-07-002, February 2007 except for those cited as EPA 2006, which are from the September 2006 EPA presentation entitled "September 2006 Revisions to the National Ambient Air Quality Standards for Particle Pollution".

³ U.S. Dollars were adjusted to 2007 values by applying the U.S. Bureau of Labor Statistics inflator from the Consumer Price Index for all urban households.

⁴ Multiplies the \$2007 costs by the number of cases.

⁵ Based on 2007 dollars inflated at an assumed annual rate of three percent (3%) each year for the 30 year period.

⁶ Net Present Value Costs represent costs in 2007 dollars and are estimated by multiplying the total yearly cost by a present worth factor of 19.6 which reflects a discount rate of three percent (3%).

APPENDIX A

Table A-1
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Acute Bronchitis Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0208	-0.0012	0.0326	1.2336	-0.0672	2.6747
	0.056	-0.0033	0.0878	3.3209	-0.1802	7.2055
	0.0234	-0.0014	0.0367	1.3901	-0.0759	3.0125
	0.044	-0.0026	0.0667	2.6109	-0.1455	5.6499
	0.0441	-0.0026	0.0668	2.6158	-0.1458	5.6605
	0.0187	-0.0011	0.0284	1.1099	-0.0618	2.4018
	0.3053	-0.0183	0.4625	18.1038	-1.0088	39.1765
	0.2907	-0.0177	0.4474	17.2391	-0.9764	37.0082
	0.0398	-0.0024	0.0612	2.3618	-0.1335	5.0819
	0.0444	-0.0027	0.0683	2.6349	-0.1491	5.6592
	0.2006	-0.012	0.3038	11.8941	-0.6628	25.7387
	0.3692	-0.0221	0.5593	21.8931	-1.22	47.3766
	0.797	-0.0478	1.2074	47.264	-2.6337	102.2791
	0.1939	-0.0116	0.2937	11.4972	-0.6407	24.8799
	0.0714	-0.0043	0.1096	4.2318	-0.2392	9.1047
	0.3761	-0.0225	0.5697	22.3018	-1.2427	48.2609
	0.3079	-0.0185	0.4665	18.261	-1.0176	39.5166
	0.3778	-0.0226	0.5724	22.4077	-1.2486	48.4902
	0.1114	-0.0067	0.1687	6.6038	-0.368	14.2907
	0.0435	-0.0026	0.0659	2.5801	-0.1438	5.5832
	0.068	-0.0041	0.1035	4.0343	-0.226	8.7113
	0.0126	-0.0008	0.0193	0.7466	-0.0422	1.6065
	0.0638	-0.0038	0.0966	3.782	-0.2107	8.1843
	0.0096	-0.0006	0.0149	0.5705	-0.0317	1.2304
	0.0099	-0.0006	0.015	0.5858	-0.0326	1.2676
	0.0337	-0.002	0.0518	1.9994	-0.113	4.3023
	0.0321	-0.0019	0.0501	1.9061	-0.105	4.1204
	0.0275	-0.0017	0.0424	1.6337	-0.0925	3.5071
	0.0143	-0.0009	0.0217	0.8503	-0.0474	1.84
	0.0143	-0.0009	0.0217	0.8503	-0.0474	1.84
	0.1016	-0.0061	0.1539	6.0235	-0.3356	13.0348
	0.0144	-0.0009	0.0218	0.8548	-0.0476	1.8497
	0.01	-0.0006	0.0151	0.5917	-0.033	1.2804
	0.01	-0.0006	0.0151	0.5917	-0.033	1.2804
	0.0097	-0.0006	0.015	0.5773	-0.0324	1.2409
	0.0285	-0.0017	0.0435	1.6915	-0.095	3.6527
SUM	4.20	-0.25	6.38	248.84	-13.89	538.00

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-2
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Acute Bronchitis Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0055	-0.0002	0.0097	0.3236	-0.0115	0.7774
	0.0148	-0.0006	0.0262	0.8762	-0.0313	2.1055
	0.0062	-0.0002	0.0109	0.3655	-0.013	0.878
	0.0115	-0.0004	0.0201	0.6842	-0.0247	1.6364
	0.012	-0.0005	0.023	0.712	-0.0252	1.7289
	0.005	-0.0002	0.0087	0.2984	-0.0108	0.712
	0.0813	-0.0032	0.1406	4.8198	-0.1742	11.5085
	0.0764	-0.003	0.1335	4.5305	-0.1629	10.8562
	0.0102	-0.0005	0.018	0.6074	-0.0274	1.4561
	0.0119	-0.0005	0.0206	0.7034	-0.0254	1.6815
	0.053	-0.0026	0.0927	3.1417	-0.1418	7.411
	0.1011	-0.004	0.1733	5.9965	-0.218	14.2755
	0.2133	-0.0083	0.3683	12.6484	-0.4577	30.2044
	0.0492	-0.0019	0.0865	2.9164	-0.1045	6.9846
	0.0193	-0.0007	0.0354	1.1457	-0.0409	2.7603
	0.1032	-0.004	0.1768	6.1185	-0.2225	14.564
	0.0857	-0.0034	0.1461	5.0815	-0.1852	12.0988
	0.1059	-0.0041	0.1906	6.2774	-0.226	15.0592
	0.0297	-0.0012	0.0513	1.7609	-0.0637	4.2047
	0.0111	-0.0004	0.0195	0.6586	-0.0236	1.5776
	0.0172	-0.0007	0.0303	1.0194	-0.0365	2.4446
	0.0034	-0.0001	0.0058	0.1991	-0.0072	0.4759
	0.0163	-0.0006	0.0287	0.9651	-0.035	2.2909
	0.0026	-0.0001	0.0045	0.155	-0.0056	0.3707
	0.0026	-0.0001	0.0045	0.1531	-0.0055	0.3663
	0.0088	-0.0004	0.0154	0.5221	-0.0235	1.2523
	0.0086	-0.0003	0.0151	0.5109	-0.0183	1.2241
	0.0074	-0.0003	0.0129	0.4417	-0.016	1.0547
	0.0037	-0.0001	0.0065	0.2199	-0.0079	0.5269
	0.0042	-0.0002	0.0078	0.2482	-0.0089	0.5986
	0.0272	-0.0013	0.047	1.6133	-0.0719	3.8549
	0.004	-0.0002	0.0077	0.2392	-0.0085	0.5789
	0.0029	-0.0001	0.0049	0.1713	-0.0075	0.4069
	0.0034	-0.0002	0.0057	0.2006	-0.0087	0.4742
	0.0033	-0.0001	0.0055	0.1947	-0.0075	0.461
	0.0083	-0.0003	0.014	0.4945	-0.0182	1.1734
SUM	1.13	-0.05	1.97	67.01	-2.48	160.03

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-3
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Asthma-Related Emergency Room Visits Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0368	0.0242	0.0476	9.5892	6.3286	12.4432
	0.0376	0.0248	0.0488	9.8124	6.4705	12.7409
	0.031	0.0204	0.0401	8.0714	5.3296	10.4696
	0.0459	0.0308	0.0586	11.9685	8.0419	15.3192
	0.0538	0.0361	0.0687	14.0275	9.4254	17.9546
	0.0326	0.0219	0.0417	8.5045	5.7144	10.8855
	0.3229	0.2164	0.4123	84.1795	56.562	107.7466
	0.2696	0.1791	0.3465	70.273	46.8143	90.5385
	0.0234	0.0156	0.03	6.1003	4.0727	7.8466
	0.0254	0.0169	0.0326	6.6121	4.4107	8.5104
	0.1957	0.1312	0.2499	51.0161	34.2788	65.2987
	0.3493	0.2341	0.4459	91.0437	61.1743	116.5326
	0.5805	0.389	0.7411	151.3057	101.6655	193.6657
	0.1518	0.1017	0.1938	39.5692	26.5874	50.6471
	0.0464	0.0309	0.0595	12.0852	8.0679	15.5453
	0.05	0.0333	0.0641	13.0252	8.6955	16.7545
	0.264	0.1769	0.337	68.8058	46.2321	88.0688
	0.2478	0.1661	0.3163	64.585	43.396	82.6664
	0.2892	0.1938	0.3693	75.3888	50.6554	96.4949
	0.0818	0.0548	0.1044	21.3158	14.3225	27.2834
	0.0669	0.0448	0.0854	17.4365	11.716	22.3181
	0.0843	0.0564	0.1078	21.9737	14.7346	28.1693
	0.0277	0.0183	0.0357	7.2097	4.7806	9.322
	0.0197	0.0131	0.0252	5.1229	3.4201	6.5894
	0.006	0.004	0.0077	1.5703	1.0551	2.0099
	0.0999	0.0669	0.1275	26.0294	17.4897	33.3166
	0.0231	0.0154	0.0296	6.0255	4.0276	7.7432
	0.0218	0.0144	0.0281	5.6696	3.7596	7.3303
	0.0128	0.0085	0.0163	3.3244	2.226	4.2664
	0.0057	0.0038	0.0073	1.4859	0.9984	1.9019
	0.0404	0.0269	0.0518	10.5187	7.0232	13.5288
	0.0508	0.0335	0.0656	13.2378	8.7599	17.1425
	0.0851	0.0565	0.1093	22.1724	14.772	28.5647
	0.0152	0.0102	0.0194	3.9697	2.6673	5.0811
	0.0071	0.0047	0.009	1.8453	1.2399	2.3619
	0.021	0.0141	0.0269	5.4837	3.6846	7.0189
	0.064	0.0429	0.0817	16.674	11.2036	21.3421
	0.017	0.0114	0.0217	4.4389	2.9826	5.6816
	0.0454	0.0304	0.0579	11.8214	7.9431	15.131
	0.0272	0.0183	0.0348	7.0978	4.7692	9.0849
	0.029	0.0192	0.0373	7.5594	5.0261	9.7537
	0.0144	0.0096	0.0184	3.7461	2.5087	4.807
	0.006	0.004	0.0077	1.5685	1.0537	2.0079
SUM	3.93	2.63	5.02	1023.26	686.09	1311.89

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-4
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Asthma-Related Emergency Room Visits Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0071	0.0042	0.0099	1.8472	1.1084	2.5783
	0.0073	0.0044	0.0102	1.9057	1.1436	2.6599
	0.006	0.0036	0.0083	1.5576	0.9348	2.174
	0.0084	0.005	0.0117	2.1851	1.3129	3.0469
	0.01	0.006	0.0139	2.6044	1.5655	3.6306
	0.0061	0.0037	0.0085	1.5978	0.9606	2.2269
	0.06	0.036	0.0834	15.6437	9.4034	21.8074
	0.0512	0.0307	0.0712	13.3391	8.0125	18.6046
	0.0043	0.0026	0.006	1.118	0.6713	1.5598
	0.0049	0.0029	0.0068	1.2679	0.7619	1.7678
	0.0366	0.0219	0.0508	9.529	5.7285	13.2824
	0.067	0.0402	0.0932	17.4769	10.5127	24.3497
	0.1085	0.0651	0.1508	28.2808	17.0016	39.4198
	0.0267	0.016	0.0372	6.9626	4.1805	9.7144
	0.0084	0.0051	0.0117	2.2	1.3207	3.0697
	0.0096	0.0057	0.0133	2.4948	1.4993	3.4783
	0.0508	0.0305	0.0705	13.23	7.9584	18.4322
	0.0484	0.0291	0.0672	12.6165	7.5921	17.5727
	0.0562	0.0337	0.0781	14.6495	8.8144	20.4062
	0.0152	0.0091	0.0212	3.9681	2.3853	5.5314
	0.0119	0.0071	0.0165	3.0898	1.8554	4.3104
	0.0149	0.0089	0.0207	3.8748	2.326	5.407
	0.0053	0.0032	0.0073	1.3727	0.8241	1.9154
	0.0037	0.0022	0.0052	0.977	0.5871	1.3623
	0.0012	0.0007	0.0016	0.3089	0.1859	0.4301
	0.0179	0.0107	0.0249	4.6593	2.7985	6.4989
	0.0042	0.0025	0.0059	1.0964	0.6583	1.5296
	0.0043	0.0026	0.006	1.1266	0.6769	1.5709
	0.0025	0.0015	0.0035	0.6538	0.3933	0.9108
	0.001	0.0006	0.0014	0.2704	0.1625	0.3771
	0.0075	0.0045	0.0105	1.9603	1.1774	2.7342
	0.01	0.006	0.0139	2.6005	1.5617	3.6277
	0.0167	0.01	0.0232	4.3436	2.6109	6.0551
	0.0027	0.0016	0.0038	0.714	0.4289	0.9958
	0.0013	0.0008	0.0018	0.3373	0.2027	0.4703
	0.0042	0.0025	0.0059	1.1023	0.6637	1.5345
	0.012	0.0072	0.0167	3.1226	1.8773	4.3523
	0.0033	0.002	0.0045	0.8506	0.5116	1.1851
	0.0093	0.0056	0.0129	2.4173	1.4562	3.3642
	0.0068	0.0041	0.0094	1.7724	1.0734	2.4567
	0.0074	0.0045	0.0103	1.9386	1.1727	2.6895
	0.003	0.0018	0.0042	0.7824	0.4713	1.0889
	0.0013	0.0008	0.0018	0.3333	0.201	0.4636
SUM	0.75	0.45	1.04	194.18	116.75	270.64

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-5
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Asthma Exacerbations Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.3893	0.0497	0.7706	28.6557	3.6875	57.3016
	0.4906	0.0626	0.971	36.1099	4.6458	72.2062
	0.3954	0.0505	0.7828	29.1073	3.7461	58.2053
	0.682	0.0875	1.3503	50.1989	6.4876	100.3738
	0.9463	0.1214	1.8736	69.6525	9.0017	139.2717
	0.3293	0.0422	0.6519	24.2355	3.1321	48.4595
	4.5131	0.5788	8.9357	332.1909	42.9316	664.2226
	3.6901	0.4722	7.3053	271.625	35.0298	543.2144
	0.5165	0.0661	1.0226	38.0206	4.9059	76.0392
	0.6409	0.082	1.2688	47.1767	6.086	94.3494
	2.5624	0.3286	5.0735	188.6096	24.3755	377.1288
	5.8923	0.7556	11.6663	433.7036	56.0508	867.1993
	10.3772	1.3308	20.5462	763.8215	98.7145	1527.2769
	2.7433	0.3518	5.4316	201.9229	26.096	403.749
	0.9817	0.1257	1.9434	72.2584	9.3235	144.5127
	4.6919	0.6017	9.2896	345.3487	44.632	690.5319
	4.1652	0.5341	8.2469	306.5845	39.6223	613.0221
	5.0534	0.648	10.0053	371.955	48.0706	743.7318
	1.4082	0.1806	2.7881	103.6492	13.3954	207.2487
	0.7882	0.1011	1.5605	58.0132	7.4975	115.9986
	0.817	0.1047	1.6176	60.1387	7.7683	120.2839
	0.2201	0.0282	0.4357	16.1986	2.0901	32.3963
	0.7141	0.0916	1.4138	52.559	6.7926	105.0928
	0.1006	0.0129	0.1992	7.407	0.9542	14.8121
	0.2245	0.0288	0.4444	16.522	2.1334	33.045
	0.1116	0.0143	0.221	8.2175	1.062	16.4311
	0.5599	0.0717	1.1084	41.2107	5.3176	82.4193
	0.4102	0.0524	0.812	30.1928	3.8877	60.3769
	0.5135	0.0657	1.0165	37.7957	4.8744	75.5865
	0.2528	0.0324	0.5005	18.6048	2.4044	37.2007
	0.2311	0.0296	0.4575	17.0089	2.1982	34.0096
	0.2484	0.0319	0.4918	18.2844	2.363	36.56
	1.2482	0.1601	2.4713	91.8712	11.8732	183.6984
	0.5106	0.0655	1.011	37.5841	4.8573	75.1503
	0.2305	0.0296	0.4563	16.9651	2.1925	33.922
	0.2261	0.029	0.4477	16.6446	2.1511	33.2812
	0.3182	0.0407	0.63	23.4246	3.0195	46.8446
	0.3779	0.0484	0.7482	27.8163	3.5919	55.6347
SUM	58.57	7.51	115.97	4311.29	556.96	8620.79

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-6
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Asthma Exacerbations Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0546	0.0077	0.1087	4.0173	0.5698	8.0638
	0.0696	0.0098	0.1384	5.1235	0.7253	10.2646
	0.0555	0.0078	0.1105	4.0845	0.5793	8.1988
	0.0875	0.0123	0.174	6.4437	0.9125	12.9107
	0.1236	0.0174	0.2458	9.099	1.2886	18.2312
	0.0435	0.0061	0.0866	3.2053	0.4539	6.4224
	0.589	0.0829	1.1733	43.3539	6.1514	87.0339
	0.5005	0.0705	0.997	36.8421	5.2266	73.9576
	0.0673	0.0095	0.134	4.9513	0.7024	9.9391
	0.0878	0.0123	0.1746	6.4628	0.9152	12.949
	0.3368	0.0473	0.6697	24.7937	3.5113	49.6788
	0.7955	0.112	1.5846	58.5509	8.3091	117.5479
	1.3651	0.1918	2.7141	100.4799	14.23	201.3299
	0.3382	0.0476	0.6737	24.8952	3.5314	49.9736
	0.1339	0.0188	0.2667	9.8534	1.398	19.7805
	0.6345	0.0893	1.264	46.7036	6.6278	93.7633
	0.5727	0.0806	1.1409	42.1528	5.9825	84.6291
	0.6924	0.0973	1.3765	50.965	7.218	102.1084
	0.1845	0.0259	0.3667	13.5776	1.9228	27.205
	0.0981	0.0138	0.195	7.2189	1.0221	14.4631
	0.1014	0.0143	0.2019	7.4604	1.0582	14.9755
	0.0299	0.0042	0.0595	2.2031	0.312	4.4142
	0.0896	0.0126	0.1785	6.5966	0.9358	13.2421
	0.0145	0.002	0.0288	1.0694	0.1508	2.1338
	0.0313	0.0044	0.0623	2.3072	0.3268	4.6231
	0.0143	0.002	0.0284	1.0494	0.1489	2.1066
	0.0742	0.0104	0.1478	5.46	0.7746	10.9605
	0.0582	0.0082	0.1163	4.2855	0.6098	8.6286
	0.072	0.0101	0.1434	5.297	0.7516	10.6339
	0.0319	0.0045	0.0635	2.3467	0.3329	4.7108
	0.0296	0.0042	0.059	2.1818	0.3096	4.38
	0.0352	0.005	0.0701	2.5902	0.3677	5.2006
	0.1649	0.0231	0.3271	12.1367	1.715	24.2644
	0.0689	0.0097	0.1371	5.0742	0.7187	10.1675
	0.0333	0.0047	0.0662	2.4516	0.3474	4.913
	0.0403	0.0057	0.0802	2.9688	0.4212	5.9517
	0.0595	0.0084	0.1184	4.3802	0.6212	8.7805
	0.0561	0.0079	0.1117	4.1279	0.586	8.2882
SUM	7.84	1.10	15.60	576.76	81.77	1156.83

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-7
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Chronic Bronchitis Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0022	0.0005	0.0036	753.2805	74.9267	2672.7759
	0.0415	0.0092	0.0675	14023.5449	1385.4272	49911.6758
	0.0384	0.0085	0.0625	12976.0029	1280.491	46205.3008
	0.0541	0.012	0.0878	18271.8301	1806.366	65013.8672
	0.0679	0.0156	0.1084	22949.4746	2320.5103	80645.2031
	0.0318	0.0073	0.0508	10745.4375	1086.5127	37759.8203
	0.0258	0.0059	0.0412	8713.668	881.0727	30620.1152
	0.0444	0.0102	0.0709	15006.2354	1517.3384	52732.4063
	0.0909	0.0206	0.1464	30724.293	3072.6294	108694.6563
	0.0167	0.0038	0.0268	5630.3169	564.632	19885.1016
	0.0373	0.0085	0.06	12605.5801	1262.7904	44549.9375
	0.0643	0.0148	0.1027	21742.9102	2198.5098	76405.2969
	0.0698	0.016	0.1115	23593.9883	2385.6792	82910.0469
	0.0788	0.0181	0.1259	26651.2754	2694.8135	93653.4531
	0.0876	0.0201	0.1398	29594.5313	2992.4175	103996.1563
	0.1036	0.0235	0.1665	35012.9219	3511.019	123663.4219
	0.0629	0.0143	0.1011	21255.7168	2131.4814	75073.7344
	0.0926	0.0213	0.1479	31292.9219	3164.1484	109964.3594
	0.0673	0.0155	0.1075	22748.1934	2300.1577	79937.8906
	0.0687	0.0158	0.1097	23211.127	2346.9668	81564.6563
	0.0774	0.0178	0.1236	26156.5645	2644.7915	91915.0313
	0.1221	0.028	0.195	41275.4297	4173.5181	145043.2188
	0.2487	0.0569	0.398	84062.1406	8477.3418	295858.25
	0.0739	0.0166	0.1196	24967.1113	2481.8804	88614.6563
	0.0264	0.006	0.0424	8909.8037	893.5084	31467.666
	0.0013	0.0003	0.0022	454.407	45.8228	1599.3423
	0.0191	0.0044	0.0304	6443.0977	651.4865	22641.2559
	0.0341	0.0078	0.0544	11520.4531	1164.8774	40483.25
	0.1559	0.0358	0.2491	52710.4844	5329.7607	185226.375
	0.1093	0.0249	0.1755	36953.1406	3711.4287	130382.1484
	0.0803	0.018	0.13	27145.002	2698.5972	96340.7109
	0.0329	0.0075	0.0527	11107.3809	1115.9889	39181.3438
	0.0281	0.0065	0.0449	9501.0166	960.5347	33389.8711
	0.0264	0.006	0.0423	8927.542	898.6119	31455.582
	0.0798	0.0183	0.1274	26970.0859	2727.0496	94773.7656
	0.007	0.0016	0.0111	2352.3718	237.8574	8266.3125
	0.0026	0.0006	0.0041	873.3868	88.3115	3069.1099
	0.0889	0.0202	0.143	30063.2715	3015.228	106169.0781
	0.2464	0.0551	0.3996	83277.1719	8256.6426	295939.5938
	0.407	0.0921	0.6556	137552.0625	13757.5723	486593.25
	0.0288	0.0066	0.046	9744.083	985.2618	34241.0273
	0.0655	0.015	0.1046	22126.377	2237.2837	77752.8203
	0.0442	0.0102	0.0706	14945.4746	1511.1948	52518.8906
	0.3707	0.0851	0.592	125285.9219	12668.1436	440258.875
	0.2558	0.0587	0.4085	86446.3359	8740.9238	303775.25
	0.1681	0.0386	0.2684	56808.8555	5744.1631	199628.1719
	0.0334	0.0077	0.0533	11288.9785	1141.4722	39669.8398
	0.1849	0.0417	0.2984	62494.6367	6234.1279	221414.2813
	0.0598	0.0136	0.0958	20208.5391	2034.5289	71194.5625
	0.0403	0.0093	0.0644	13620.3643	1376.8757	47869.0508
	0.037	0.0085	0.0591	12515.4893	1265.4895	43979.8398
SUM	4.30	0.98	6.90	1454210.23	146248.17	5126572.30

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-8
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Chronic Bronchitis Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0004	0.0001	0.0008	141.9912	12.2918	502.9351
	0.008	0.0015	0.0157	2690.3333	232.153	9505.8018
	0.0076	0.0014	0.0146	2565.4792	219.3799	8942.0293
	0.0105	0.0019	0.0204	3542.0149	306.6649	12406.7871
	0.0122	0.0023	0.0236	4116.4819	358.6058	14593.7197
	0.0059	0.0011	0.0112	1983.8845	170.874	6943.168
	0.0047	0.0009	0.0091	1603.2745	140.2845	5695.2109
	0.0082	0.0015	0.0156	2754.8828	238.8607	9705.4551
	0.0172	0.0032	0.0331	5811.3647	500.5186	20444.4336
	0.0031	0.0006	0.0059	1039.9543	89.059	3627.5757
	0.0071	0.0013	0.0136	2395.9966	207.4963	8437.7627
	0.0119	0.0022	0.0227	4003.4006	347.9302	14127.6387
	0.0132	0.0025	0.025	4452.8179	388.4768	15771.2832
	0.0146	0.0027	0.0278	4916.8242	426.7774	17338.3535
	0.0155	0.0028	0.0297	5235.7847	448.3624	18263.1016
	0.0187	0.0034	0.0365	6307.5112	545.9309	22338.2852
	0.0123	0.0022	0.0229	4141.1313	357.0033	14589.6641
	0.0176	0.0033	0.0332	5942.1191	516.1328	20952.8984
	0.013	0.0024	0.0244	4376.5566	381.4537	15438.2734
	0.0131	0.0024	0.0248	4421.123	387.0771	15682.0469
	0.0143	0.0026	0.0272	4839.374	417.094	16946.7305
	0.0217	0.0039	0.0416	7342.7979	629.0724	25619.1953
	0.0438	0.008	0.0849	14816.5371	1267.2246	52121.3633
	0.0141	0.0026	0.0273	4769.5034	408.2205	16777.0703
	0.005	0.0009	0.0096	1698.5547	145.8249	5932.585
	0.0003	0	0.0005	85.9035	7.4236	301.5421
	0.0037	0.0007	0.0069	1246.6665	108.8158	4398.1494
	0.0062	0.0012	0.0119	2105.9663	182.421	7413.1372
	0.028	0.0051	0.0535	9452.2334	810.2899	32990.4727
	0.02	0.0036	0.0384	6772.2905	579.9824	23623.6426
	0.0158	0.0029	0.0305	5326.5674	463.9874	18884.1719
	0.0063	0.0012	0.0119	2126.1638	183.3454	7449.0166
	0.0052	0.001	0.01	1771.2147	155.3045	6302.2803
	0.0051	0.001	0.0097	1725.4358	150.8002	6117.501
	0.0145	0.0027	0.0276	4901.0415	420.5307	17113.9688
	0.0013	0.0002	0.0024	433.0053	37.5656	1526.2539
	0.0005	0.0001	0.001	170.8491	15.0213	605.0914
	0.0167	0.003	0.0318	5625.6748	482.2831	19635.4531
	0.0485	0.0089	0.0935	16376.6504	1406.8914	57604.3984
	0.0791	0.0146	0.1512	26712.1523	2315.6738	94093.2188
	0.0052	0.0009	0.0099	1740.3949	149.9042	6122.7319
	0.0121	0.0022	0.0227	4081.7822	346.2734	14215.918
	0.0087	0.0016	0.0163	2934.595	258.2122	10392.7354
	0.069	0.0127	0.1308	23288.6816	2010.2875	81666.3125
	0.0479	0.009	0.0916	16186.8984	1420.686	57641.0469
	0.0337	0.0063	0.0629	11362.4287	999.2728	40188.9727
	0.0081	0.0015	0.0143	2729.0735	245.0632	9578.126
	0.046	0.0088	0.0828	15544.3369	1395.7085	54679.4141
	0.0122	0.0023	0.0229	4120.3008	363.5441	14620.7607
	0.0083	0.0016	0.0155	2814.0693	249.4624	10015.4668
	0.0087	0.0017	0.0156	2946.4075	264.9241	10367.7676
SUM	0.82	0.15	1.57	278490.48	24166.44	980250.92

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-9
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Cardiovascular Hospital Admissions¹ Based on Maximum 24 Hour Mean Concentrations²

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0086	-0.0022	0.021	185.3865	-46.2119	451.7592
	0.0171	-0.0038	0.0392	367.487	-82.0811	841.0017
	0.005	-0.0014	0.0126	107.7445	-29.6689	271.1063
	0.0202	-0.0046	0.0473	433.9605	-98.1977	1016.0143
	0.0032	-0.0009	0.008	68.7932	-18.9153	171.7855
	0.0047	-0.0013	0.0118	100.5897	-27.9955	254.2496
	0.0074	-0.0018	0.0179	159.6632	-39.0275	384.2975
	0.0096	-0.0021	0.0227	206.8359	-45.9512	487.4118
	0.0043	-0.0012	0.011	93.3556	-26.0002	236.669
	0.0025	-0.0007	0.0063	53.909	-14.8045	134.7991
	0.0092	-0.002	0.0214	196.9216	-43.7728	459.9885
	0.014	-0.0034	0.0338	301.5418	-73.4021	726.6184
	0.0182	-0.004	0.0426	390.8759	-86.2541	915.7578
	0.029	-0.0074	0.0706	623.2277	-158.0565	1516.5746
	0.0133	-0.0031	0.032	285.5418	-66.357	686.4929
	0.0417	-0.0095	0.0975	895.9048	-203.0258	2093.3022
	0.0313	-0.007	0.0721	672.6423	-149.7712	1547.2372
	0.0147	-0.0028	0.0343	316.607	-59.5715	735.9542
	0.038	-0.0083	0.0845	817.0103	-177.2247	1814.4432
	0.0112	-0.0026	0.0261	239.9767	-55.1924	561.332
	0.0262	-0.0059	0.0623	562.96	-127.3911	1338.359
	0.0116	-0.0027	0.028	249.4453	-58.5995	600.3188
	0.0058	-0.0014	0.0138	125.1274	-29.0456	296.2347
	0.0015	-0.0004	0.0039	32.7337	-9.1018	82.7219
	0.0024	-0.0006	0.0056	51.7301	-12.2505	120.9634
	0.0177	-0.0041	0.0419	380.2035	-87.416	898.9274
	0.0095	-0.0021	0.022	203.0605	-45.0608	472.1816
	0.0014	-0.0004	0.0035	29.9891	-8.3334	75.7763
	0.0272	-0.006	0.0633	583.0256	-128.9532	1360.0668
	0.0063	-0.0014	0.0147	134.8238	-31.0117	314.7448
	0.0405	-0.0089	0.0925	869.2907	-192.0504	1986.2943
	0.0065	-0.0016	0.0155	140.1412	-33.7113	333.1378
	0.0026	-0.0006	0.0061	55.9906	-13.1949	130.2891
	0.0016	-0.0004	0.0039	33.6839	-9.267	84.1611
	0.2563	-0.0589	0.608	5503.8799	-1264.0396	13057.0713
	0.042	-0.009	0.0984	902.3917	-192.4407	2112.8625
	0.0527	-0.0132	0.1276	1130.6355	-284.1116	2740.489
	0.0015	-0.0004	0.0038	32.9847	-9.0363	82.0658
	0.0075	-0.0017	0.0176	160.447	-36.6145	378.3909
	0.0157	-0.0034	0.0369	336.4229	-73.6794	792.1455
	0.0072	-0.0017	0.0172	155.1698	-37.231	369.1818
	0.0075	-0.0021	0.0189	160.7921	-44.7506	406.4164
SUM	0.85	-0.20	2.02	18352.90	-4228.77	43339.60

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Incidence and cost values were generated from pooled estimates of epidemiological studies with study populations between the ages of 65-99 only.

² Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-10
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Cardiovascular Hospital Admissions¹ Based on Maximum 24 Hour Mean Concentrations²

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0001	0.0001	0.0002	3.0656	1.8441	4.2718
	0.0179	0.0108	0.0249	411.5496	247.4541	573.7093
	0.0136	0.0082	0.0189	312.0146	187.5913	434.9818
	0.0121	0.0073	0.0168	277.6639	166.9601	387.0554
	0.0336	0.0202	0.0468	772.6821	465.3989	1075.7034
	0.0093	0.0056	0.0129	213.3529	128.5059	297.0231
	0.0094	0.0057	0.0131	217.2904	130.8775	302.5048
	0.0121	0.0073	0.0169	279.1219	168.1196	388.5846
	0.0314	0.0189	0.0437	721.6041	434.2706	1005.2401
	0.0076	0.0046	0.0106	174.9678	105.3199	243.702
	0.0141	0.0085	0.0197	325.1511	195.7051	452.9116
	0.0288	0.0174	0.0402	663.6419	399.7223	923.9012
	0.0262	0.0158	0.0364	602.3826	362.8248	838.6179
	0.035	0.0211	0.0487	805.3642	485.0839	1121.2025
	0.025	0.0151	0.0348	575.4609	346.6095	801.1384
	0.0385	0.0232	0.0536	885.0402	532.7374	1232.7233
	0.018	0.0109	0.0251	415.0495	249.8332	578.0992
	0.0291	0.0175	0.0405	670.0134	403.5599	932.7713
	0.0245	0.0147	0.0341	563.0353	339.1253	783.8398
	0.0201	0.0121	0.028	462.3785	278.498	643.7087
	0.0343	0.0206	0.0477	788.2567	474.7798	1097.3859
	0.044	0.0265	0.0613	1013.5455	610.4749	1411.0258
	0.0828	0.0498	0.1152	1904.4261	1146.8381	2651.688
	0.0219	0.0132	0.0305	503.866	303.097	702.1591
	0.0081	0.0049	0.0113	186.3676	112.1819	259.5802
	0.0086	0.0052	0.0119	197.5005	118.9577	274.9539
	0.0144	0.0087	0.0201	332.4161	200.2197	462.7792
	0.0507	0.0305	0.0706	1166.8494	702.8123	1624.4507
	0.0373	0.0224	0.0519	857.856	516.4375	1194.7473
	0.0252	0.0152	0.0351	579.6991	348.7161	807.832
	0.0154	0.0093	0.0214	353.5865	212.8684	492.434
	0.0116	0.007	0.0161	266.3425	160.4205	370.7969
	0.0116	0.007	0.0162	267.8451	161.2724	372.9831
	0.0371	0.0223	0.0516	852.7286	513.6123	1187.1417
	0.0028	0.0017	0.0038	63.3676	38.1673	88.2184
	0.0017	0.001	0.0024	39.7772	23.9584	55.3765
	0.0363	0.0219	0.0506	835.2253	502.7592	1163.3263
	0.0632	0.038	0.0881	1454.165	874.5743	2026.7418
	0.1054	0.0635	0.1469	2426.2493	1460.1597	3379.8972
	0.0214	0.0129	0.0298	492.2921	296.5155	685.3534
	0.0295	0.0177	0.041	678.0591	408.406	943.9723
	0.023	0.0139	0.032	529.1038	318.6877	736.6014
	0.1389	0.0837	0.1934	3196.4783	1925.2905	4450.0352
	0.1022	0.0615	0.1422	2350.4282	1415.7009	3272.1912
	0.0622	0.0375	0.0866	1431.5031	862.2175	1992.8929
	0.0158	0.0095	0.022	363.7924	219.118	506.4602
	0.0544	0.0327	0.0758	1252.0144	753.3376	1744.3851
	0.0439	0.0264	0.0611	1010.0032	608.1434	1406.4459
	0.0219	0.0132	0.0304	502.9366	302.9214	700.182
	0.023	0.0139	0.0321	530.202	319.3492	738.1303
SUM	1.56	0.94	2.17	35777.71	21542.04	49821.86

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Incidence and cost values were estimated from the Moolgavkar (2000) all cardiovascular study with a study population of 20-64 years.

² Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-11
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Cardiovascular Hospital Admissions¹ Based on Annual Average Concentrations²

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0014	-0.0003	0.0033	36.2433	-8.6024	86.6814
	0.0027	-0.0006	0.0062	70.0942	-15.3599	163.0063
	0.0008	-0.0002	0.002	21.204	-4.5247	52.0682
	0.0029	-0.0006	0.0068	77.0942	-16.5009	178.1316
	0.0005	-0.0001	0.0012	12.3341	-3.2553	30.651
	0.0007	-0.0002	0.0018	18.3861	-4.8783	45.9286
	0.0011	-0.0003	0.0026	28.6942	-6.7232	68.6354
	0.0015	-0.0003	0.0035	38.7329	-8.2041	90.481
	0.0006	-0.0002	0.0016	16.8879	-4.4784	42.1804
	0.0004	-0.0001	0.001	10.0985	-2.6788	25.2249
	0.0014	-0.0003	0.0032	35.6006	-7.534	82.5909
	0.0022	-0.0005	0.0051	56.6504	-13.0832	134.245
	0.0027	-0.0006	0.0063	70.3095	-14.8564	164.5413
	0.0041	-0.001	0.0098	106.1934	-25.7124	255.8672
	0.0019	-0.0004	0.0046	50.7406	-11.3504	121.5058
	0.0064	-0.0014	0.0149	167.632	-36.416	390.6704
	0.0048	-0.001	0.011	124.2415	-26.577	286.3526
	0.0023	-0.0005	0.0053	59.4538	-12.9605	138.4793
	0.0058	-0.0012	0.0134	150.704	-31.8002	350.211
	0.0016	-0.0004	0.0038	41.9872	-9.466	100.4342
	0.0036	-0.0008	0.0087	94.8717	-20.7462	227.4575
	0.0016	-0.0004	0.0039	42.4958	-9.5984	101.9107
	0.0009	-0.0002	0.0021	22.963	-5.186	55.0354
	0.0002	-0.0001	0.0006	6.0815	-1.6167	15.2213
	0.0004	-0.0001	0.0009	9.8548	-2.2264	22.9242
	0.0025	-0.0006	0.0059	65.9349	-14.3878	154.3915
	0.0014	-0.0003	0.0032	36.6116	-7.6366	83.3319
	0.0002	-0.0001	0.0006	5.7736	-1.5355	14.4543
	0.0039	-0.0008	0.0091	101.8833	-21.5985	237.6821
	0.0009	-0.0002	0.0022	23.9059	-5.403	57.0709
	0.0064	-0.0014	0.0148	166.4893	-36.0869	387.0362
	0.001	-0.0002	0.0024	27.0272	-6.256	63.9016
	0.0004	-0.0001	0.0009	9.8418	-2.22	22.8711
	0.0002	-0.0001	0.0006	6.4569	-1.7339	16.3169
	0.0376	-0.0083	0.0899	982.7527	-218.1601	2350.7905
	0.0063	-0.0014	0.0149	164.6677	-35.518	389.6273
	0.0087	-0.0021	0.0207	228.6233	-54.1288	540.9608
	0.0003	-0.0001	0.0008	8.0001	-2.1287	19.999
	0.0015	-0.0003	0.0037	40.4253	-9.0268	96.6831
	0.0026	-0.0005	0.0062	68.851	-14.3758	160.8933
	0.0012	-0.0003	0.0029	31.7494	-7.3911	75.91
	0.0015	-0.0004	0.0037	38.5518	-10.2771	96.5713
SUM	0.13	-0.03	0.31	3377.10	-752.20	7998.93

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Incidence and cost values were generated from pooled estimates of epidemiological studies with study populations between the ages of 65-99 only.

² Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-12
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Cardiovascular Hospital Admissions¹ Based on Annual Average Concentrations²

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0028	0.0017	0.0039	64.5757	38.505	90.5987
	0.0021	0.0013	0.003	49.4572	29.4903	69.3875
	0.0019	0.0011	0.0027	43.6085	26.003	61.1817
	0.0048	0.0029	0.0067	110.6867	66.0071	155.279
	0.0014	0.0008	0.0019	31.1041	18.5492	43.634
	0.0014	0.0008	0.002	32.0722	19.1269	44.9914
	0.0018	0.0011	0.0025	40.7319	24.2909	57.1402
	0.0048	0.0028	0.0067	109.4966	65.2957	153.6125
	0.0011	0.0007	0.0016	25.4866	15.1978	35.756
	0.0022	0.0013	0.003	49.7331	29.6581	69.7688
	0.0042	0.0025	0.0059	97.3602	58.0622	136.5795
	0.004	0.0024	0.0055	90.9364	54.2339	127.5632
	0.0051	0.0031	0.0072	118.2359	70.5119	165.8644
	0.0034	0.0021	0.0048	79.3242	47.3014	111.2868
	0.0056	0.0033	0.0078	128.0284	76.3431	179.6172
	0.0028	0.0016	0.0039	63.3112	37.7556	88.8165
	0.0044	0.0026	0.0062	101.3216	60.4278	142.131
	0.0038	0.0022	0.0053	86.5667	51.6295	121.4305
	0.0031	0.0018	0.0043	70.699	42.1654	99.1731
	0.005	0.003	0.007	115.2366	68.7227	161.6578
	0.0061	0.0036	0.0086	140.7384	83.9239	197.4453
	0.0115	0.0068	0.0161	264.1699	157.5231	370.6184
	0.0034	0.002	0.0047	77.4015	46.1544	108.5903
	0.0012	0.0007	0.0017	28.2993	16.8762	39.7001
	0.0013	0.0008	0.0019	30.5839	18.2409	42.9009
	0.0021	0.0013	0.0029	48.2559	28.7776	67.6956
	0.0071	0.0042	0.01	163.7417	97.6427	229.7142
	0.0054	0.0032	0.0075	123.7296	73.7807	173.5845
	0.004	0.0024	0.0057	93.093	55.5152	130.5975
	0.0023	0.0014	0.0033	54.0035	32.2057	75.7577
	0.0017	0.001	0.0024	39.925	23.8107	56.0064
	0.0018	0.0011	0.0025	41.7544	24.9022	58.5718
	0.0053	0.0032	0.0074	121.7584	72.6092	170.812
	0.0004	0.0002	0.0006	9.2773	5.5327	13.0145
	0.0003	0.0002	0.0004	6.2731	3.7415	8.7992
	0.0054	0.0032	0.0075	123.7793	73.8123	173.6505
	0.0101	0.006	0.0141	231.6889	138.1596	325.0405
	0.0165	0.0099	0.0232	380.4293	226.8725	533.6809
	0.003	0.0018	0.0042	69.4274	41.4014	97.3995
	0.0042	0.0025	0.0059	97.2523	57.9957	136.4322
	0.0036	0.0022	0.0051	83.8222	49.9954	117.576
	0.0204	0.0122	0.0287	470.2224	280.4255	659.6385
	0.0154	0.0092	0.0216	354.1588	211.2176	496.8063
	0.01	0.006	0.0141	230.9037	137.726	323.8764
	0.0031	0.0019	0.0044	72.4604	43.2389	101.6025
	0.0114	0.0068	0.0159	261.5976	156.0867	366.8337
	0.0073	0.0043	0.0102	167.6609	100.004	235.1688
	0.0037	0.0022	0.0052	84.5073	50.4094	118.5272
	0.0045	0.0027	0.0063	102.9688	61.4405	144.387
SUM	0.24	0.14	0.33	5481.86	3269.30	7689.90

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Incidence and cost values were estimated from the Moolgavkar (2000) all cardiovascular study with a study population of 20-64 years.

² Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-13
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Respiratory Hospital Admissions (Chronic Lung Disease) Based on
Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0052	0.0028	0.0076	98.2276	53.1954	142.456
	0.0093	0.005	0.0135	174.2506	94.3543	252.7325
	0.0031	0.0017	0.0045	58.0499	31.4394	84.1831
	0.0104	0.0057	0.0151	195.8888	106.3667	283.5334
	0.002	0.0011	0.0028	36.7682	19.965	53.2191
	0.0029	0.0016	0.0042	54.4185	29.549	78.7664
	0.0045	0.0024	0.0065	83.77	45.4867	121.2504
	0.005	0.0027	0.0072	93.2484	50.5685	135.0975
	0.0027	0.0015	0.0039	50.6632	27.4834	73.3831
	0.0015	0.0008	0.0022	28.8567	15.652	41.8014
	0.0046	0.0025	0.0067	86.5197	46.9798	125.2303
	0.0084	0.0046	0.0122	158.5698	86.1027	229.5171
	0.0091	0.0049	0.0132	171.0624	92.8861	247.5991
	0.0175	0.0095	0.0253	328.7226	178.4949	475.7997
	0.008	0.0044	0.0117	151.1456	81.9918	218.9279
	0.0226	0.0123	0.0327	424.1823	230.1057	614.4098
	0.0159	0.0086	0.023	298.3947	162.0269	431.9024
	0.0079	0.0043	0.0115	149.1612	80.9939	215.8989
	0.0169	0.0092	0.0245	317.861	172.5971	460.0785
	0.0067	0.0036	0.0097	125.1994	67.9827	181.2162
	0.0149	0.0081	0.0215	279.5161	151.776	404.5772
	0.007	0.0038	0.0102	131.9371	71.6193	191.0115
	0.0035	0.0019	0.0051	66.0781	35.8456	95.7109
	0.0009	0.0005	0.0014	17.7063	9.6114	25.6344
	0.0015	0.0008	0.0021	27.4014	14.8788	39.6613
	0.0099	0.0054	0.0143	185.3243	100.6302	268.2421
	0.0048	0.0026	0.0069	90.0871	48.8787	130.4692
	0.0009	0.0005	0.0013	16.2202	8.8029	23.4865
	0.0135	0.0073	0.0196	253.7947	137.8094	367.3476
	0.0037	0.002	0.0054	70.3846	38.1823	101.9474
	0.02	0.0109	0.029	376.1492	203.7843	545.3585
	0.0039	0.0021	0.0056	72.6412	39.3937	105.2411
	0.0016	0.0009	0.0023	29.5139	16.0259	42.719
	0.001	0.0005	0.0014	18.0135	9.7812	26.0731
	0.1507	0.0818	0.2181	2829.0942	1536.1852	4094.8875
	0.0232	0.0126	0.0335	435.0945	236.2543	629.7646
	0.0317	0.0172	0.0458	594.7023	322.9206	860.784
	0.0009	0.0005	0.0014	17.565	9.5377	25.424
	0.0045	0.0024	0.0065	83.9088	45.4906	121.5922
	0.0076	0.0041	0.011	142.7718	77.4857	206.727
	0.0043	0.0023	0.0062	80.5949	43.7615	116.6571
	0.0046	0.0025	0.0067	86.9876	47.2339	125.9077
SUM	0.48	0.26	0.69	8990.45	4880.11	13016.23

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-14
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Respiratory Hospital Admissions (Pneumonia) Based on
Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0122	0.004	0.0198	221.6598	73.3709	361.3047
	0.0323	0.0107	0.0527	589.3527	194.9973	960.9023
	0.0063	0.0021	0.0103	115.211	38.1453	187.7632
	0.0406	0.0136	0.0658	740.3066	247.3036	1199.6682
	0.004	0.0013	0.0064	72.4505	24.2025	117.4061
	0.0059	0.002	0.0095	107.2297	35.8207	173.7659
	0.0105	0.0035	0.0171	191.9244	64.1134	311.0138
	0.0181	0.006	0.0295	330.7486	110.0011	537.4907
	0.0055	0.0018	0.0089	100.0973	33.3275	162.5506
	0.0031	0.001	0.0051	57.0332	18.981	92.6432
	0.0179	0.006	0.0291	327.3287	109.346	530.4368
	0.0201	0.0067	0.0326	366.4254	122.4065	593.7932
	0.0346	0.0116	0.0561	631.7436	211.0375	1023.7416
	0.0395	0.0132	0.064	720.7236	240.7618	1167.934
	0.0205	0.0068	0.0332	373.0219	124.1947	605.7705
	0.0792	0.0264	0.1287	1445.0038	481.1029	2346.6184
	0.0622	0.0208	0.1007	1133.8602	378.7724	1837.4225
	0.0282	0.0094	0.0457	514.0731	171.729	833.0563
	0.086	0.0287	0.1394	1569.1412	524.1804	2542.7961
	0.0184	0.0062	0.0299	336.2099	112.3128	544.8287
	0.0432	0.0144	0.07	787.58	263.0955	1276.2747
	0.0176	0.0059	0.0286	321.1923	107.1832	520.8421
	0.0098	0.0032	0.0158	177.8541	59.2165	288.8224
	0.0019	0.0006	0.0031	34.9199	11.6527	56.6264
	0.0044	0.0015	0.0072	80.75	26.975	130.8555
	0.0329	0.011	0.0533	599.5398	200.2796	971.5553
	0.0184	0.0061	0.0299	336.0887	111.9706	545.5671
	0.0018	0.0006	0.0028	32.0077	10.6731	51.9281
	0.0529	0.0177	0.0858	965.5991	322.5638	1564.7551
	0.0106	0.0035	0.0171	192.4657	64.0847	312.5406
	0.0843	0.028	0.1373	1538.1039	509.811	2504.9487
	0.0092	0.003	0.0149	167.1674	55.5993	271.6519
	0.0048	0.0016	0.0077	86.9754	29.0546	140.9438
	0.0019	0.0007	0.0032	35.4949	11.8573	57.5196
	0.4231	0.1414	0.6857	7717.0679	2577.9299	12505.5225
	0.0698	0.0233	0.1131	1273.3481	425.3691	2063.4629
	0.0722	0.0241	0.1169	1315.988	439.6132	2132.561
	0.0019	0.0006	0.0031	34.6112	11.5621	56.0875
	0.0119	0.004	0.0194	217.6408	72.312	353.9052
	0.0303	0.0101	0.0492	553.2436	184.4967	897.515
	0.0102	0.0034	0.0166	186.7418	62.3762	302.6337
	0.0094	0.0031	0.0152	171.406	57.2591	277.7637
SUM	1.47	0.49	2.38	26769.33	8931.04	43415.19

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-15
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Respiratory Hospital Admissions (Chronic Lung Disease - Less Asthma)
Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0045	0.0021	0.0069	56.7189	26.2636	86.4179
	0.0032	0.0015	0.0049	40.1242	18.5762	61.1413
	0.0023	0.0011	0.0036	29.5254	13.6731	44.9822
	0.0085	0.0039	0.0128	106.3778	49.4448	161.6504
	0.002	0.0009	0.003	24.6292	11.4478	37.4263
	0.002	0.0009	0.003	24.8468	11.5489	37.7569
	0.0027	0.0012	0.0041	33.589	15.6123	51.0415
	0.0069	0.0032	0.0104	86.3638	40.069	131.4052
	0.002	0.0009	0.0031	25.6096	11.8872	38.9533
	0.003	0.0014	0.0046	38.104	17.6835	57.9651
	0.0073	0.0034	0.0111	91.6251	42.5877	139.2324
	0.0063	0.0029	0.0095	78.9883	36.714	120.0296
	0.0088	0.0041	0.0134	111.02	51.6025	168.7047
	0.0055	0.0026	0.0084	69.3059	32.2136	105.3164
	0.0089	0.0041	0.0135	111.7342	51.8629	169.954
	0.004	0.0018	0.006	49.7322	23.0838	75.6454
	0.0069	0.0032	0.0105	86.5664	40.2364	131.5452
	0.0061	0.0028	0.0093	76.7641	35.6803	116.6499
	0.0043	0.002	0.0066	54.7036	25.4265	83.127
	0.0087	0.0041	0.0133	110.0009	51.1288	167.156
	0.0112	0.0052	0.017	140.9366	65.5079	214.1656
	0.0193	0.009	0.0293	242.4989	112.6654	368.6107
	0.0053	0.0024	0.008	66.2612	30.7122	100.8877
	0.0019	0.0009	0.0028	23.5144	10.9146	35.7664
	0.0021	0.001	0.0032	26.2281	12.1909	39.8559
	0.0028	0.0013	0.0043	35.6889	16.5883	54.2324
	0.0114	0.0053	0.0174	143.8712	66.8719	218.625
	0.0077	0.0036	0.0117	97.2347	45.1448	147.8718
	0.0052	0.0024	0.0079	65.6245	30.4175	99.9174
	0.003	0.0014	0.0046	37.9588	17.6249	57.7242
	0.0023	0.0011	0.0035	28.9642	13.4623	44.0145
	0.0025	0.0011	0.0037	30.9497	14.3748	47.0553
	0.0088	0.0041	0.0134	110.9492	51.5696	168.5971
	0.0005	0.0002	0.0008	6.6216	3.0777	10.0621
	0.0005	0.0002	0.0008	6.2336	2.8974	9.4724
	0.0084	0.0039	0.0128	106.2512	49.3194	161.6106
	0.0137	0.0063	0.0208	172.1264	79.7472	262.1525
	0.0241	0.0112	0.0367	303.6312	140.8739	461.9787
	0.0055	0.0025	0.0083	68.9476	32.0471	104.772
	0.0069	0.0032	0.0105	86.6666	40.2829	131.6975
	0.0051	0.0024	0.0078	64.2176	29.8486	97.5843
	0.0349	0.0162	0.053	438.7733	203.9435	666.7547
	0.0235	0.0109	0.0357	295.9157	137.5427	449.67
	0.0141	0.0065	0.0214	177.1129	82.3227	269.1386
	0.0038	0.0018	0.0058	47.8295	22.2313	72.6811
	0.0124	0.0058	0.0189	156.5506	72.6029	238.2646
	0.0114	0.0053	0.0174	143.8626	66.8204	218.7206
	0.0052	0.0024	0.0079	65.345	30.3714	99.3003
	0.006	0.0028	0.0091	75.4197	35.0554	114.6069
SUM	0.36	0.17	0.55	4572.51	2123.7725	6951.8916

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-16
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Respiratory Hospital Admissions (Asthma) Based on
Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0002	0.0001	0.0003	1.436	0.7211	2.1218
	0.0065	0.0033	0.0096	51.6806	25.9104	76.4522
	0.0058	0.0029	0.0086	46.0187	23.0656	68.0894
	0.0071	0.0036	0.0105	56.4129	28.2875	83.4433
	0.0099	0.005	0.0147	79.1206	39.898	116.5607
	0.0067	0.0034	0.0098	53.1129	26.7832	78.2462
	0.0053	0.0027	0.0077	41.8241	21.0906	61.6154
	0.0232	0.0117	0.0341	184.2587	92.9158	271.4505
	0.0251	0.0126	0.037	199.5069	100.3244	294.5022
	0.0027	0.0013	0.0039	21.1541	10.645	31.211
	0.0055	0.0028	0.0081	43.7698	22.0196	64.5911
	0.0189	0.0095	0.0278	150.2641	75.7734	221.3696
	0.0267	0.0135	0.0394	212.5145	107.1643	313.0771
	0.0389	0.0196	0.0573	309.1581	155.8986	455.4527
	0.0159	0.008	0.0235	126.7573	63.9197	186.7393
	0.0144	0.0073	0.0213	114.6376	57.6862	169.1396
	0.0077	0.0039	0.0113	60.8883	30.6393	89.8363
	0.023	0.0116	0.0339	182.8862	92.2237	269.4285
	0.0204	0.0103	0.0301	162.4356	81.9111	239.3005
	0.0215	0.0108	0.0317	171.0546	86.2574	251.9982
	0.0128	0.0065	0.0189	102.1341	51.503	150.4643
	0.0169	0.0085	0.0249	134.449	67.7983	198.0707
	0.0337	0.017	0.0497	267.9976	135.0528	395.003
	0.0097	0.0049	0.0143	77.159	38.7421	114.0206
	0.004	0.002	0.0059	31.5537	15.8783	46.5548
	0.0024	0.0012	0.0036	19.3865	9.776	28.5603
	0.0039	0.002	0.0058	31.1456	15.7057	45.8837
	0.0228	0.0115	0.0336	181.5544	91.5521	267.4665
	0.0137	0.0069	0.0202	108.6746	54.708	160.2947
	0.0104	0.0052	0.0153	82.494	41.4217	121.9027
	0.0039	0.0019	0.0057	30.7719	15.4924	45.3855
	0.0033	0.0016	0.0048	25.9876	13.1042	38.2861
	0.0036	0.0018	0.0054	28.99	14.6021	42.7429
	0.0088	0.0044	0.013	70.1327	35.3657	103.3198
	0.0013	0.0006	0.0019	10.2344	5.1609	15.0774
	0.0003	0.0002	0.0005	2.6919	1.3574	3.9657
	0.0127	0.0064	0.0188	101.2513	50.9526	149.3841
	0.0299	0.015	0.0443	238.1715	119.5106	352.1173
	0.0505	0.0254	0.0746	401.6593	201.9845	592.8985
	0.0051	0.0026	0.0075	40.7271	20.5374	59.9993
	0.0081	0.0041	0.0119	64.3359	32.4425	94.7798
	0.0067	0.0034	0.0098	53.0068	26.7296	78.0898
	0.03	0.0152	0.0443	238.9434	120.4916	352.0122
	0.0289	0.0146	0.0426	229.9622	115.9626	338.781
	0.0191	0.0096	0.0282	152.0392	76.6685	223.9846
	0.0058	0.0029	0.0085	45.7804	23.0856	67.4439
	0.0214	0.0108	0.0316	170.2493	85.5584	251.4259
	0.0083	0.0042	0.0123	66.1306	33.3114	97.4996
	0.0049	0.0025	0.0072	39.1257	19.7287	57.6426
	0.0043	0.0021	0.0063	33.8522	17.0706	49.8711
SUM	0.67	0.34	0.99	5349.48	2694.39	7887.55

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-17
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Respiratory Hospital Admissions (Chronic Lung Disease) Based on
Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0008	0.0004	0.0011	10.5968	6.0677	14.6718
	0.0013	0.0008	0.0019	18.4549	10.873	26.2908
	0.0005	0.0003	0.0006	6.3291	3.5894	8.6789
	0.0014	0.0008	0.0019	19.1232	11.0628	26.7436
	0.0003	0.0002	0.0004	3.7403	2.1133	5.1085
	0.0004	0.0002	0.0006	5.5293	3.1667	7.6546
	0.0006	0.0004	0.0008	8.4153	4.8195	11.65
	0.0007	0.0004	0.001	9.6367	5.5746	13.4771
	0.0004	0.0002	0.0005	5.2057	2.9079	7.0306
	0.0002	0.0001	0.0003	3.0368	1.7391	4.2042
	0.0006	0.0004	0.0009	8.5801	5.0042	12.0964
	0.0012	0.0007	0.0017	16.4783	9.4379	22.8112
	0.0013	0.0007	0.0017	17.4555	9.9012	23.9333
	0.0023	0.0013	0.0031	31.2233	17.8632	43.1891
	0.0011	0.0006	0.0015	15.1768	8.6152	20.83
	0.0032	0.0019	0.0045	44.5619	25.4969	61.6354
	0.0023	0.0013	0.0031	31.0625	17.791	43.0001
	0.0011	0.0007	0.0016	15.7867	9.0422	21.8531
	0.0025	0.0014	0.0034	33.7797	19.1624	46.3128
	0.0009	0.0005	0.0013	12.5998	7.216	17.443
	0.0019	0.0011	0.0027	26.7199	15.301	36.9934
	0.0009	0.0005	0.0013	12.5975	7.2136	17.4415
	0.0005	0.0003	0.0007	7.0712	3.9538	9.558
	0.0001	0.0001	0.0002	1.8342	1.0495	2.5368
	0.0002	0.0001	0.0003	2.9209	1.673	4.0433
	0.0013	0.0007	0.0018	17.9033	10.2524	24.7864
	0.0006	0.0004	0.0009	8.7802	5.1203	12.3796
	0.0001	0.0001	0.0002	1.7417	0.9967	2.4089
	0.0018	0.001	0.0025	25.1885	14.2866	34.5375
	0.0005	0.0003	0.0007	7.2469	4.1102	9.9369
	0.003	0.0017	0.0042	41.2112	23.5995	57.056
	0.0006	0.0003	0.0008	7.8702	4.4876	10.8478
	0.0002	0.0001	0.0003	2.9168	1.6689	4.0344
	0.0001	0.0001	0.0002	1.9662	1.1252	2.7191
	0.0209	0.0119	0.0289	286.4947	164.0797	396.6142
	0.0033	0.0019	0.0045	44.6759	25.8478	62.4739
	0.0048	0.0028	0.0067	66.0295	37.8241	91.396
	0.0002	0.0001	0.0002	2.3835	1.38	3.3313
	0.0009	0.0005	0.0012	12.0562	6.9093	16.6829
	0.0012	0.0007	0.0016	16.3096	9.3427	22.5752
	0.0007	0.0004	0.0009	9.3211	5.34	12.9011
	0.0008	0.0005	0.0012	11.2995	6.6631	16.0871
SUM	0.07	0.04	0.09	931.31	533.67	1289.96

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-18
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Respiratory Hospital Admissions (Pneumonia) Based on
Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.002	0.0006	0.0033	36.3003	11.4883	60.8838
	0.0053	0.0017	0.009	97.4593	30.8445	163.4597
	0.001	0.0003	0.0017	18.8889	5.9783	31.6801
	0.0061	0.0019	0.0103	111.5919	35.3373	187.0955
	0.0006	0.0002	0.001	11.1127	3.5196	18.6298
	0.0009	0.0003	0.0015	16.6501	5.274	27.9108
	0.0016	0.0005	0.0027	29.4665	9.3326	49.3984
	0.0029	0.0009	0.0048	52.5964	16.6531	88.1912
	0.0008	0.0003	0.0014	15.2992	4.8431	25.6561
	0.0005	0.0002	0.0008	9.1464	2.8965	15.3346
	0.0028	0.0009	0.0046	50.5207	16.0016	84.6915
	0.0032	0.001	0.0053	58.1806	18.4327	97.516
	0.0054	0.0017	0.009	97.5737	30.9051	163.5693
	0.0057	0.0018	0.0096	104.5743	33.1039	175.3673
	0.0031	0.001	0.0052	56.6222	17.9232	94.9568
	0.0127	0.004	0.0213	231.1883	73.2146	387.594
	0.0099	0.0031	0.0166	180.3428	57.1368	302.2678
	0.0046	0.0014	0.0076	83.118	26.3379	139.298
	0.0138	0.0044	0.0232	252.3219	79.9498	422.882
	0.0028	0.0009	0.0048	51.7111	16.3781	86.689
	0.0063	0.002	0.0106	115.1076	36.4407	193.0235
	0.0026	0.0008	0.0043	46.8547	14.8309	78.5782
	0.0016	0.0005	0.0026	28.3277	8.9707	47.4933
	0.0003	0.0001	0.0005	5.518	1.7479	9.2498
	0.0007	0.0002	0.0012	13.149	4.1669	22.0356
	0.0049	0.0015	0.0081	88.5451	28.0341	148.4723
	0.0028	0.0009	0.0047	50.8934	16.1109	85.3458
	0.0003	0.0001	0.0005	5.2389	1.6598	8.7808
	0.008	0.0025	0.0133	145.0854	45.9423	243.2552
	0.0016	0.0005	0.0028	29.9258	9.4748	50.1793
	0.014	0.0044	0.0235	256.0175	81.0524	429.3062
	0.0015	0.0005	0.0025	27.4625	8.6978	46.0391
	0.0007	0.0002	0.0012	13.1266	4.1568	22.0079
	0.0003	0.0001	0.0005	5.9118	1.8738	9.9058
	0.0655	0.0207	0.1098	1194.2931	378.2828	2002.0503
	0.0111	0.0035	0.0185	201.8055	63.9345	338.2483
	0.0122	0.0039	0.0205	223.1263	70.7361	373.8268
	0.0004	0.0001	0.0007	7.2301	2.2975	12.0952
	0.0026	0.0008	0.0044	47.4706	15.077	79.4393
	0.0053	0.0017	0.0089	96.3765	30.5538	161.4689
	0.0018	0.0006	0.003	32.9668	10.4554	55.2185
	0.0019	0.0006	0.0032	34.9221	11.0939	58.4324
SUM	0.23	0.07	0.39	4234.02	1341.14	7097.52

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-19
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Respiratory Hospital Admissions (Chronic Lung Disease - Less Asthma)
Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0007	0.0003	0.0011	9.0078	4.0954	13.9013
	0.0005	0.0002	0.0008	6.4365	2.9264	9.9331
	0.0004	0.0002	0.0006	4.6937	2.134	7.2435
	0.0012	0.0006	0.0019	15.4598	7.0304	23.8543
	0.0003	0.0001	0.0004	3.6426	1.6566	5.6202
	0.0003	0.0001	0.0005	3.7204	1.692	5.74
	0.0004	0.0002	0.0006	4.9725	2.2614	7.6722
	0.0011	0.0005	0.0016	13.2796	6.0386	20.4912
	0.0003	0.0001	0.0005	3.7815	1.7194	5.8353
	0.0005	0.0002	0.0007	5.9067	2.6861	9.1139
	0.0011	0.0005	0.0017	13.6362	6.2017	21.0394
	0.001	0.0004	0.0015	12.0957	5.5016	18.661
	0.0013	0.0006	0.002	16.5345	7.5198	25.511
	0.0008	0.0004	0.0012	9.693	4.4073	14.9576
	0.0013	0.0006	0.002	16.3847	7.4498	25.2843
	0.0006	0.0003	0.0009	7.6891	3.4967	11.8639
	0.0011	0.0005	0.0016	13.2791	6.0399	20.4866
	0.001	0.0004	0.0015	11.9717	5.4456	18.4688
	0.0007	0.0003	0.001	8.4844	3.8592	13.0891
	0.0013	0.0006	0.002	16.3138	7.4193	25.1708
	0.0016	0.0007	0.0024	19.8556	9.0284	30.6394
	0.0027	0.0012	0.0042	34.1203	15.5136	52.6537
	0.0008	0.0004	0.0013	10.3085	4.6871	15.9077
	0.0003	0.0001	0.0004	3.6191	1.6458	5.5842
	0.0003	0.0001	0.0005	4.1197	1.874	6.3554
	0.0004	0.0002	0.0006	5.2559	2.3902	8.1095
	0.0016	0.0007	0.0025	20.4832	9.3141	31.607
	0.0011	0.0005	0.0017	14.2187	6.4651	21.9413
	0.0008	0.0004	0.0013	10.6719	4.8531	16.4667
	0.0005	0.0002	0.0007	5.8772	2.6729	9.068
	0.0003	0.0002	0.0005	4.4042	2.0032	6.7949
	0.0004	0.0002	0.0006	4.8917	2.225	7.5468
	0.0013	0.0006	0.002	16.0721	7.3088	24.7994
	0.0001	0	0.0001	0.9835	0.4473	1.5174
	0.0001	0	0.0001	0.9971	0.4536	1.5381
	0.0013	0.0006	0.002	15.9614	7.258	24.6295
	0.0022	0.001	0.0034	27.7653	12.6251	42.8446
	0.0038	0.0017	0.0059	48.24	21.9387	74.4307
	0.0008	0.0004	0.0012	9.8651	4.4859	15.2224
	0.001	0.0005	0.0015	12.6107	5.7348	19.4582
	0.0008	0.0004	0.0013	10.3186	4.6942	15.9173
	0.0052	0.0024	0.008	65.479	29.7796	101.0267
	0.0036	0.0016	0.0055	45.2296	20.5721	69.7799
	0.0023	0.001	0.0036	28.9745	13.1822	44.6932
	0.0008	0.0003	0.0012	9.656	4.3973	14.8844
	0.0026	0.0012	0.0041	33.1096	15.0748	51.045
	0.0019	0.0009	0.003	24.2092	11.0142	37.3426
	0.0009	0.0004	0.0014	11.1343	5.0665	17.1727
	0.0012	0.0005	0.0018	14.847	6.7604	22.8882
SUM	0.06	0.03	0.09	710.26	323.0472	1095.8024

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-20
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Respiratory Hospital Admissions (Asthma) Based on
Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0011	0.0005	0.0016	8.3745	4.0816	12.6414
	0.0009	0.0005	0.0014	7.5307	3.6704	11.3676
	0.0012	0.0006	0.0017	9.1513	4.4603	13.8136
	0.0015	0.0007	0.0022	11.7776	5.7423	17.7738
	0.001	0.0005	0.0015	8.0453	3.923	12.1404
	0.0008	0.0004	0.0012	6.4136	3.1276	9.6777
	0.0035	0.0017	0.0053	27.9377	13.6227	42.158
	0.0039	0.0019	0.006	31.3612	15.2891	47.3306
	0.0004	0.0002	0.0006	3.1951	1.5575	4.8225
	0.0009	0.0004	0.0013	6.9379	3.3827	10.4699
	0.0029	0.0014	0.0043	22.9039	11.1686	34.5612
	0.0042	0.002	0.0063	33.3256	16.2532	50.2813
	0.0059	0.0029	0.0089	47.1566	22.9949	71.1575
	0.0023	0.0011	0.0034	18.1611	8.8527	27.4112
	0.0022	0.0011	0.0033	17.1957	8.3819	25.9549
	0.0012	0.0006	0.0018	9.6276	4.6943	14.5288
	0.0036	0.0018	0.0055	28.7289	14.0114	43.3454
	0.0033	0.0016	0.0049	25.9398	12.6524	39.1346
	0.0034	0.0017	0.0052	27.1667	13.2504	40.9866
	0.002	0.001	0.0029	15.5135	7.5646	23.4097
	0.0024	0.0012	0.0037	19.4037	9.4589	29.2861
	0.0049	0.0024	0.0073	38.6124	18.8208	58.2817
	0.0015	0.0008	0.0023	12.26	5.976	18.505
	0.0006	0.0003	0.0009	4.9669	2.4217	7.4954
	0.0004	0.0002	0.0006	3.118	1.5209	4.7039
	0.0006	0.0003	0.0009	4.6979	2.2907	7.0892
	0.0033	0.0016	0.005	26.4778	12.908	39.9612
	0.002	0.001	0.0031	16.26	7.9261	24.5417
	0.0017	0.0008	0.0026	13.6992	6.6792	20.6736
	0.0006	0.0003	0.0009	4.8741	2.3767	7.3549
	0.0005	0.0002	0.0008	4.0467	1.9735	6.1058
	0.0006	0.0003	0.0009	4.6883	2.2866	7.0736
	0.0013	0.0006	0.002	10.4062	5.0736	15.7043
	0.0002	0.0001	0.0003	1.5568	0.7591	2.3492
	0.0001	0	0.0001	0.4409	0.2151	0.665
	0.002	0.001	0.003	15.5579	7.5846	23.4804
	0.0049	0.0024	0.0074	39.2177	19.1181	59.1904
	0.0082	0.004	0.0124	65.2303	31.8069	98.4329
	0.0008	0.0004	0.0011	5.9691	2.91	9.0086
	0.0012	0.0006	0.0018	9.5886	4.6751	14.4702
	0.0011	0.0005	0.0017	8.7203	4.2542	13.1543
	0.0046	0.0022	0.0069	36.5196	17.8082	55.1062
	0.0045	0.0022	0.0068	35.9946	17.5547	54.3086
	0.0032	0.0016	0.0048	25.4635	12.4238	38.4079
	0.0012	0.0006	0.0018	9.4519	4.6185	14.2416
	0.0046	0.0023	0.007	36.7424	17.9476	55.3746
	0.0014	0.0007	0.0022	11.384	5.5543	17.171
	0.0009	0.0004	0.0013	6.8236	3.3301	10.2905
	0.0009	0.0004	0.0013	6.8161	3.3299	10.2716
SUM	0.11	0.05	0.16	845.43	412.28	1275.67

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-21
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Lower Respiratory Symptoms Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.2643	0.1485	0.3591	4.15	1.8374	7.2311
	0.7298	0.4096	0.9926	11.4602	5.0714	19.9791
	0.3112	0.175	0.4227	4.8872	2.1643	8.5127
	0.5912	0.3404	0.7896	9.284	4.1663	16.006
	0.5933	0.3416	0.7924	9.3171	4.1811	16.0629
	0.2365	0.1362	0.3159	3.7144	1.6669	6.4037
	3.9986	2.3026	5.3405	62.7968	28.1804	108.2639
	3.7402	2.1287	5.0369	58.7405	26.1819	101.7123
	0.5077	0.2898	0.6823	7.973	3.5609	13.7876
	0.5928	0.338	0.7974	9.3101	4.1548	16.1079
	2.6769	1.5415	3.5753	42.0404	18.8659	72.4792
	4.9968	2.8774	6.6737	78.4731	35.2152	135.2904
	10.7652	6.199	14.378	169.0645	75.8686	291.4732
	2.5913	1.4922	3.4609	40.6958	18.2624	70.161
	0.9647	0.5506	1.2965	15.1495	6.7657	26.1986
	5.0375	2.9008	6.7281	79.1128	35.5023	136.3934
	4.1398	2.3838	5.529	65.0138	29.1753	112.086
	5.0407	2.9026	6.7324	79.163	35.5248	136.4798
	1.4628	0.8423	1.9537	22.9729	10.3092	39.606
	0.5846	0.3366	0.7808	9.181	4.12	15.8283
	0.8936	0.5131	1.1958	14.0327	6.2894	24.2169
	0.1725	0.0984	0.2318	2.7082	1.2095	4.6832
	0.8955	0.5156	1.196	14.0631	6.3109	24.2453
	0.1161	0.0656	0.157	1.8228	0.809	3.1658
	0.1248	0.0719	0.1667	1.9603	0.8797	3.3796
	0.4352	0.2485	0.5848	6.8342	3.0525	11.8177
	0.4043	0.228	0.548	6.3494	2.8152	11.0437
	0.3359	0.1912	0.4523	5.275	2.3513	9.1334
	0.2013	0.1159	0.2689	3.1616	1.4188	5.4507
	0.2013	0.1159	0.2689	3.1616	1.4188	5.4507
	1.3844	0.7972	1.849	21.7421	9.7569	37.4842
	0.2024	0.1165	0.2703	3.1784	1.4263	5.4797
	0.1261	0.0726	0.1684	1.98	0.8886	3.4137
	0.1261	0.0726	0.1684	1.98	0.8886	3.4137
	0.1181	0.0671	0.1594	1.8553	0.8254	3.2165
	0.3958	0.2269	0.5303	6.2147	2.7833	10.732
SUM	55.96	32.15	74.85	878.82	393.90	1516.39

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-22
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Lower Respiratory Symptoms Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0519	0.0256	0.0773	0.8146	0.3309	1.5045
	0.1444	0.0712	0.2153	2.2676	0.9212	4.188
	0.0612	0.0302	0.0912	0.9611	0.3905	1.775
	0.1103	0.0545	0.1642	1.7321	0.7043	3.1968
	0.1125	0.0556	0.1676	1.7676	0.7189	3.2616
	0.0454	0.0225	0.0676	0.713	0.2901	1.3155
	0.7592	0.3754	1.1304	11.9245	4.85	22.0033
	0.7244	0.3578	1.0792	11.3771	4.6251	21.0023
	0.095	0.0469	0.1416	1.4918	0.6063	2.7546
	0.116	0.0573	0.1728	1.8219	0.7409	3.3625
	0.5108	0.2526	0.7605	8.0235	3.2636	14.8042
	0.9799	0.485	1.4579	15.3896	6.2626	28.3852
	2.0558	1.0167	3.0603	32.2882	13.1337	59.5745
	0.466	0.2301	0.6945	7.3188	2.9744	13.5139
	0.1886	0.0932	0.2808	2.9618	1.2045	5.4659
	0.9895	0.4898	1.4721	15.5407	6.3243	28.6632
	0.8261	0.4091	1.2285	12.9738	5.281	23.9236
	1.0006	0.4954	1.4883	15.7146	6.3961	28.9799
	0.2782	0.1376	0.4142	4.3698	1.7774	8.0631
	0.1059	0.0523	0.1578	1.6627	0.6758	3.0699
	0.161	0.0795	0.24	2.5284	1.0274	4.6689
	0.0336	0.0166	0.05	0.5272	0.2144	0.973
	0.1638	0.0809	0.2441	2.5726	1.0458	4.7494
	0.0235	0.0116	0.035	0.3692	0.1501	0.6815
	0.0232	0.0115	0.0346	0.3646	0.1482	0.6729
	0.0828	0.0409	0.1233	1.3002	0.5285	2.4003
	0.0809	0.04	0.1206	1.2714	0.5168	2.3474
	0.0671	0.0332	0.0999	1.0543	0.4288	1.9454
	0.037	0.0183	0.0551	0.5811	0.2362	1.0728
	0.0413	0.0205	0.0614	0.6491	0.2643	1.1965
	0.2649	0.131	0.3943	4.1603	1.6923	7.6759
	0.0396	0.0196	0.0589	0.6222	0.2532	1.1477
	0.0263	0.0131	0.0391	0.4135	0.1684	0.762
	0.0321	0.016	0.0475	0.5044	0.2062	0.926
	0.0309	0.0154	0.0457	0.4846	0.198	0.8904
	0.0844	0.0418	0.1253	1.325	0.5398	2.4417
SUM	10.81	5.35	16.10	169.84	69.09	313.36

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-23
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Infant Mortality¹ Based on Maximum 24 Hour Mean Concentrations²

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0001	0.0001	0.0002	823.6024	121.3731	2100.499
	0.0001	0	0.0001	618.772	91.1509	1577.7911
	0.0001	0	0.0001	621.406	91.5979	1585.0107
	0.0001	0.0001	0.0002	697.4514	103.3964	1781.4965
	0.0001	0.0001	0.0002	721.6776	106.9879	1843.3774
	0.0001	0.0001	0.0002	712.4122	105.6143	1819.7109
	0.0008	0.0004	0.0012	4987.5669	739.4012	12739.7168
	0.0007	0.0003	0.001	4201.085	621.6187	10733.2188
	0.0005	0.0003	0.0008	3317.5334	491.8206	8473.959
	0.0007	0.0004	0.0011	4516.3862	669.5493	11536.1836
	0.0009	0.0005	0.0013	5686.5952	843.0314	14525.2402
	0.0002	0.0001	0.0003	1409.8566	209.0097	3601.1895
	0.0003	0.0001	0.0004	1801.7886	266.7442	4603.355
	0.0001	0	0.0001	455.1818	67.387	1162.9351
	0.0004	0.0002	0.0006	2375.7388	352.2007	6068.3374
	0.0005	0.0002	0.0007	2838.0913	420.7439	7249.3223
	0.0005	0.0002	0.0007	2843.4634	421.5403	7263.0439
	0.0001	0.0001	0.0002	700.8543	103.9009	1790.1885
	0.0002	0.0001	0.0003	1434.7573	212.7012	3664.7935
	0.0003	0.0002	0.0004	1902.1268	281.8698	4859.0215
	0.0002	0.0001	0.0003	1080.4243	159.5742	2758.4561
	0.0001	0	0.0001	449.796	66.5903	1149.1736
	0.0005	0.0002	0.0007	2899.0552	429.7817	7405.042
	0.0001	0.0001	0.0002	925.8221	137.1005	2365.2813
	0.0001	0.0001	0.0002	649.6266	95.95	1658.6008
	0.0001	0.0001	0.0002	688.1382	101.878	1758.1035
	0.0002	0.0001	0.0003	1276.8842	188.4089	3258.5073
	0.0004	0.0002	0.0006	2467.5764	365.1464	6304.6963
	0.0001	0	0.0001	483.824	71.7264	1235.8292
	0.0001	0	0.0001	476.6725	70.6662	1217.562
	0.0002	0.0001	0.0003	1440.6127	213.5692	3679.7495
	0.0001	0.0001	0.0002	725.0878	107.4935	1852.0879
	0.0001	0.0001	0.0002	657.5814	97.2329	1679.678
SUM	0.01	0.00	0.01	56887.45	8426.76	145301.16

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Incidence and cost values were estimated from the Woodruff et al. (1997) study with an infant study population (< 1 year).

² Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-24
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Mortality¹ Based on Maximum 24 Hour Mean Concentrations²

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0003	0.0001	0.0004	1611.009	227.8569	4175.9165
	0.0426	0.0178	0.0657	269009.3438	37978.2969	697434.1875
	0.0827	0.0345	0.1274	521537.4063	73608.9219	1352198.625
	0.0244	0.0102	0.0376	153819.9688	21719.791	398784.25
	0.1192	0.0494	0.1808	751851	106288.6563	1958624.5
	0.0161	0.0067	0.0244	101447.7734	14341.5996	264278.5313
	0.0187	0.0078	0.0284	118114.8906	16697.8203	307697.5625
	0.0305	0.0126	0.0462	192186.6719	27169.293	500659.6875
	0.0742	0.0311	0.1139	467928.375	66281.4531	1212775.125
	0.0181	0.0076	0.0278	114169.3359	16171.9395	295903.6875
	0.0193	0.0081	0.0296	121751.4844	17245.9414	315555.0938
	0.0676	0.028	0.1026	426500.0625	60294.0156	1111062.5
	0.0628	0.026	0.0953	396345.4063	56031.0703	1032507.5
	0.1093	0.0453	0.1658	689212.6875	97433.5156	1795447.25
	0.0918	0.038	0.1392	578989.9375	81851.4063	1508309.5
	0.0797	0.0334	0.1224	502886.5938	71233.2344	1303379.75
	0.1813	0.0761	0.2783	1143509	161976.5625	2963742.5
	0.1581	0.0655	0.2399	997491.6875	141014.6875	2598535.75
	0.0828	0.0343	0.1256	522256.4688	73831.0313	1360514.5
	0.2094	0.0868	0.3177	1320904.25	186735.3125	3441048
	0.0683	0.0283	0.1037	430988.4688	60928.5391	1122755.125
	0.1279	0.053	0.1941	806963.125	114079.8125	2102195.5
	0.1155	0.0483	0.1767	728454.3125	103072.4375	1890398.5
	0.0266	0.0111	0.0409	167788.3438	23727.3438	434930.9375
	0.0273	0.0114	0.0419	172124	24381.1445	446110.375
	0.0032	0.0013	0.0048	19978.5625	2826.7124	51843.293
	0.0176	0.0073	0.0266	110776.4375	15660.3867	288580.375
	0.0142	0.0059	0.0215	89439.3203	12643.9746	232995.6875
	0.1186	0.0492	0.1799	748192.4375	105771.4531	1949093.75
	0.0775	0.0325	0.119	488794.3125	69237.0859	1266855.375
	0.0272	0.0114	0.0419	171843.7344	24301.3906	445442.3125
	0.0153	0.0064	0.0235	96600.6875	13683.3623	250369.3281
	0.0116	0.0048	0.0176	73042.0781	10326.7617	190295.4219
	0.0152	0.0064	0.0233	95729.4531	13558.957	248093.0625
	0.1484	0.0615	0.2251	936165.5625	132345.0625	2438776.5
	0.0023	0.001	0.0035	14722.2715	2081.2771	38352.5469
	0.002	0.0008	0.003	12309.0508	1740.1218	32065.9375
	0.0578	0.0242	0.0887	364252.9063	51595.9609	944069.5
	0.2564	0.1072	0.3946	1617399.75	228552.9844	4192769.5
	0.1344	0.0564	0.2064	847859.375	120098.1875	2197479
	0.0225	0.0093	0.0342	142038.5469	20079.8906	370020.3438
	0.0397	0.0165	0.0603	250602.5469	35427.5078	652837.125
	0.0263	0.0109	0.0399	165865.2344	23448.2539	432090.5313
	0.9121	0.3781	1.3838	5753797	813410.25	14989044
	0.2362	0.0979	0.3583	1490020.875	210643.2031	3881608.5
	0.1845	0.0765	0.2799	1163821.25	164528.5938	3031835.5
	0.0201	0.0083	0.0305	126727.5859	17915.3887	330134.2188
	0.0844	0.0354	0.1297	532393.125	75362.1484	1379936.375
	0.1121	0.047	0.1721	707320	100161.6719	1832693.5
	0.0404	0.0168	0.0613	254878.8125	36036.5859	664060.6875
	0.04	0.0166	0.0607	252211.9844	35655.0313	657029.875
SUM	4.47	1.86	6.82	28224624.50	3991413.89	73407397.10

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Incidence and cost values were estimated from the Pope et al. (1997) study with a study population age range of 30-99 years.

² Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-25
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Infant Mortality¹ Based on Annual Average Concentrations²

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0001	0.0001	0.0002	878.7139	121.3077	2334.0391
	0.0001	0.0001	0.0002	773.0322	105.9226	2050.2925
	0.0001	0	0.0002	586.9396	81.1167	1559.3167
	0.0001	0.0001	0.0002	817.0934	113.3923	2166.7334
	0.0002	0.0001	0.0003	1006.6406	139.1411	2674.3999
	0.0001	0	0.0001	318.2615	43.3511	846.2402
	0.0001	0	0.0001	430.3865	59.7333	1141.0632
	0.0001	0	0.0001	520.8311	72.3604	1378.1492
	0.0001	0	0.0001	519.5545	72.1528	1375.7136
	0.0001	0	0.0001	322.995	43.9576	859.3052
	0.0001	0	0.0001	495.3913	67.8171	1313.8003
	0.0001	0	0.0001	465.7472	64.2845	1237.0686
SUM	0.0013	0.0004	0.0018	7135.59	984.54	18936.12

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Incidence and cost values were estimated from the Woodruff et al. (1997) study with an infant study population (< 1 year).

² Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-26
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Mortality¹ Based on Annual Average Concentrations²

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0082	0.0029	0.014	51923.625	6754.2998	139892.7031
	0.0161	0.0057	0.0274	101550.0547	13207.3574	273644.5625
	0.0047	0.0017	0.008	29722.6016	3864.5332	80116.5
	0.0225	0.008	0.0376	141897.9531	18504.9883	381801.125
	0.0031	0.0011	0.0051	19457.4004	2541.0066	52292.5547
	0.0036	0.0013	0.006	22911.5391	2995.1875	61625.9297
	0.0059	0.0021	0.0097	36893.6484	4818.4521	99159.4688
	0.014	0.005	0.0235	88101.5625	11472.7461	237415.7344
	0.0033	0.0012	0.0056	21076.9063	2738.5874	56908.793
	0.0037	0.0013	0.0062	23333.9434	3043.9348	62760.6094
	0.0131	0.0047	0.0217	82272.1406	10749.9043	221202.8438
	0.0124	0.0045	0.0205	78489.5625	10278.9023	211402.8906
	0.0211	0.0075	0.0351	133036.4531	17383.9121	357707.625
	0.0168	0.006	0.0283	105552.2656	13713.9316	285008.9688
	0.0146	0.0052	0.0248	92216.3125	11974.3398	248876.6875
	0.0349	0.0125	0.0582	219996.7188	28708.6055	591461.75
	0.0314	0.0113	0.0517	197847.2656	25913.9512	532947.125
	0.0167	0.006	0.0274	105152.7656	13793.8877	282910.9375
	0.042	0.0151	0.069	264628.0313	34696.1133	712330.25
	0.0131	0.0047	0.0219	82872.125	10825.0547	222763
	0.0235	0.0084	0.0396	148083.4844	19253.8164	399589.75
	0.0211	0.0075	0.0357	132645.3281	17226.168	357879.25
	0.0051	0.0018	0.0086	31852.1641	4135.9399	85962.3281
	0.0052	0.0019	0.0087	32988.7617	4303.4238	88728.6406
	0.0006	0.0002	0.001	3913.5352	511.6622	10527.2188
	0.0036	0.0013	0.0058	22450.9746	2946.8098	60360.1797
	0.0027	0.001	0.0045	17086.9082	2230.7222	45911.5742
	0.022	0.0078	0.037	138599.1563	18040.1914	373654.5
	0.0143	0.0051	0.0242	90284.2031	11731.5381	243758.3125
	0.0054	0.0019	0.009	33956.7539	4428.1299	91370.75
	0.003	0.0011	0.005	18835.9238	2460.8687	50638.9961
	0.0023	0.0008	0.0038	14366.3516	1880.1697	38674.4609
	0.0031	0.0011	0.005	19234.791	2519.6104	51817.3594
	0.028	0.01	0.0468	176166.7813	22967.1328	474152.0625
	0.0004	0.0002	0.0007	2834.6187	370.3143	7620.3042
	0.0004	0.0001	0.0007	2537.0349	333.4497	6807.7305
	0.0108	0.0039	0.0182	68342.5547	8896.2734	184233.5
	0.0503	0.0179	0.0847	317000.9375	41232.5898	855136.5
	0.0261	0.0093	0.0434	164591.3594	21494.6484	442347.8125
	0.0042	0.0015	0.007	26430.041	3441.8555	71221.8438
	0.0075	0.0027	0.0126	47349.9023	6175.6016	127387.6563
	0.0054	0.002	0.0089	34328.5078	4513.6543	92076.2969
	0.1765	0.0631	0.293	1112683.375	145419.0313	2992171.5
	0.0467	0.0167	0.0771	294572.6875	38570.3086	793290.125
	0.0388	0.014	0.063	244848.2656	32244.7383	657086
	0.0051	0.0019	0.0079	31967.1719	4229.3496	85202.7813
	0.0211	0.0078	0.0331	132819.6406	17579.4375	353024.8125
	0.0239	0.0086	0.0387	150668.9063	19843.332	404363.375
	0.0088	0.0032	0.0142	55616.918	7350.1592	149526.9063
	0.0099	0.0037	0.0155	62243.7539	8236.8359	165478.75
SUM	0.88	0.31	1.46	5528233.67	722547.46	14872231.34

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Incidence and cost values were estimated from the Pope et al. (1997) study with a study population age range of 30-99 years.

² Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-27
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Minor Restricted Activity Days Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	2.9392	2.5269	3.342	148.591	88.5298	214.5607
	50.9054	43.7277	57.9234	2573.3997	1532.2449	3715.21
	47.9196	41.1575	54.5325	2422.4475	1442.2162	3497.1729
	76.9613	66.1149	87.5651	3890.6038	2316.6741	5616.9595
	82.2733	70.8748	93.3737	4159.7139	2482.2319	6005.564
	55.3555	47.6863	62.8242	2798.7585	1670.1071	4040.6919
	43.8185	37.7477	49.7306	2215.4521	1322.0298	3198.5469
	80.4524	69.3062	91.3072	4067.6526	2427.2959	5872.6514
	140.6962	121.037	159.8783	7113.104	4240.0918	10272.5371
	19.8061	17.0445	22.4994	1001.3443	597.0564	1446.2241
	55.6782	47.9085	63.2572	2814.925	1678.2375	4065.4226
	96.4299	83.0701	109.4404	4875.4673	2909.3442	7038.9287
	113.6929	97.9414	129.0326	5748.2822	3430.1807	8299.0508
	126.479	108.9561	143.5438	6394.7437	3815.9443	9232.375
	111.8231	96.3307	126.9105	5653.7451	3373.7671	8162.5635
	139.5815	120.1185	158.5632	7056.8618	4207.6611	10192.083
	64.9292	55.8756	73.7589	3282.645	1957.2809	4741.0586
	136.3533	117.4623	154.7503	6893.9839	4113.8564	9953.1523
	105.3377	90.7438	119.5501	5325.8447	3178.0986	7689.1582
	97.4409	83.941	110.5878	4926.5845	2939.8474	7112.729
	106.3547	91.6198	120.7043	5377.2627	3208.7813	7763.3936
	166.0655	143.0581	188.4714	8396.2266	5010.292	12122.0059
	382.9713	329.8048	434.7714	19362.5098	11551.3555	27958.7363
	107.9902	92.8321	122.7956	5459.3413	3252.4656	7883.002
	39.5931	34.0726	44.9771	2001.723	1193.5364	2891.0535
	24.4791	21.0877	27.7819	1237.6572	738.549	1786.8608
	47.7642	41.1467	54.2086	2414.9443	1441.073	3486.5625
	217.6345	187.4825	246.9982	11003.542	6566.1592	15886.3018
	154.4856	132.9712	175.462	7810.4199	4657.7148	11280.4648
	119.6378	102.8459	136.0389	6048.1816	3603.3013	8733.2734
	44.1041	37.9637	50.0906	2229.8018	1329.7822	3220.4038
	41.1303	35.4312	46.6805	2079.5332	1240.9047	3002.3408
	35.1829	30.2915	39.9501	1778.7775	1060.9995	2568.7561
	94.7095	81.5881	107.488	4788.4883	2857.4414	6913.3535
	17.6202	15.179	19.9976	890.874	531.6125	1286.1943
	3.483	3.0004	3.9529	176.0992	105.0839	254.2422
	132.2325	113.7969	150.2117	6685.3257	3986.2051	9655.5352
	385.8481	331.5828	438.8743	19505.877	11617.9902	28163.4512
	650.9768	560.0245	739.7201	32911.1094	19618.375	47529.4063
	44.6695	38.4808	50.6964	2258.479	1347.7053	3260.6665
	96.7397	83.337	109.792	4891.1328	2918.6926	7061.5459
	59.9384	51.6343	68.0254	3030.4678	1808.3752	4375.2207
	274.0314	236.0659	311.0042	13854.9492	8267.6836	20003.0059
	346.0033	298.0665	392.6867	17493.8301	10439.1191	25256.6211
	186.2633	160.4576	211.3943	9417.4219	5619.6719	13596.3516
	48.3332	41.637	54.8545	2443.7156	1458.2417	3528.1006
	275.2585	236.7242	312.8736	13915.8691	8293.2285	20095.5313
	69.6869	60.0001	79.1275	3523.2363	2101.5708	5087.8955
	47.1265	40.5962	53.4864	2382.7004	1421.8	3440.0566
	41.5937	35.8312	47.2057	2102.9678	1254.907	3036.1484
SUM	5910.78	5088.18	6712.69	298836.62	178225.31	431493.12

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-28
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Minor Restricted Activity Days Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.4848	0.4106	0.5588	24.5063	14.5542	35.5089
	8.5694	7.2572	9.8769	433.1395	257.2462	627.6168
	8.1434	6.8965	9.3859	411.6089	244.4585	596.4182
	12.9719	10.9858	14.951	655.6652	389.4047	950.0521
	12.8153	10.8551	14.7682	647.7567	384.6856	938.5558
	8.773	7.4315	10.1094	443.4367	263.3408	642.5021
	7.0297	5.955	8.1003	355.3215	211.0097	514.8261
	12.7627	10.8111	14.7069	645.0986	383.1	934.6925
	23.0594	19.5314	26.5745	1165.5492	692.1995	1688.8198
	3.1225	2.6446	3.5987	157.827	93.7327	228.6864
	9.2056	7.7976	10.6083	465.3026	276.33	674.1906
	15.3776	13.0264	17.7199	777.2713	461.59	1126.1951
	18.6486	15.7986	21.4875	942.6133	559.7635	1365.7327
	20.1836	17.0976	23.258	1020.1985	605.8542	1478.1736
	16.7697	14.2032	19.3272	847.6318	503.4046	1228.1924
	21.8546	18.5095	25.188	1104.6492	656.05	1600.6093
	10.7122	9.0739	12.3443	541.4532	321.5524	784.5251
	22.4038	18.98	25.8142	1132.4214	672.4783	1640.7395
	17.5925	14.9048	20.2696	889.2355	528.0553	1288.3773
	16.1854	13.7123	18.6486	818.1075	485.8201	1185.3276
	16.9017	14.3173	19.4763	854.3081	507.3408	1237.8174
	25.0848	21.246	28.9098	1267.9207	753.007	1837.1691
	57.708	48.8745	66.5105	2916.8687	1732.3315	4226.4805
	17.8583	15.1248	20.5821	902.6542	536.0856	1307.9238
	6.5031	5.5085	7.4941	328.7056	195.2089	476.271
	4.1172	3.4883	4.7436	208.1096	123.5809	301.52
	7.5381	6.3854	8.6866	381.0207	226.2752	552.0684
	33.2179	28.1353	38.282	1679.0116	997.1404	2432.8076
	24.1387	20.4444	27.8199	1220.0997	724.6107	1767.8854
	20.6709	17.5091	23.821	1044.8245	620.494	1513.8806
	7.2931	6.178	8.404	368.6357	218.9181	534.12
	6.6992	5.6753	7.7192	338.6182	201.0874	490.6197
	5.9423	5.0342	6.8468	300.3596	178.3657	435.1839
	14.7054	12.456	16.9465	743.293	441.4235	1076.9839
	2.8042	2.3754	3.2313	141.7403	84.174	205.369
	0.5964	0.5053	0.6871	30.1474	17.902	43.6786
	21.2059	17.9613	24.4387	1071.8607	636.5618	1553.0741
	66.0587	55.9502	76.1308	3338.9629	1982.974	4838.0195
	110.2029	93.3514	126.991	5570.2876	3307.9893	8070.874
	6.8516	5.8033	7.896	346.3151	205.6705	501.7924
	15.0871	12.7794	17.3862	762.5853	452.8788	1104.9338
	10.3099	8.7356	11.8778	521.1286	309.4524	755.0258
	43.8171	37.1178	50.4909	2214.7698	1315.2585	3208.9929
	56.6489	47.9912	65.2729	2863.3745	1700.3958	4148.689
	32.6118	27.6336	37.5693	1648.4146	978.8292	2388.2373
	10.411	8.8285	11.9855	526.2551	312.4145	762.3179
	61.7221	52.331	71.0669	3119.9072	1852.2473	4519.5625
	12.5226	10.611	14.4262	632.9742	375.8601	917.0581
	8.5885	7.2784	9.8929	434.1203	257.7697	628.9387
	8.7399	7.4106	10.0625	441.7795	262.273	639.9619
SUM	983.22	832.92	1132.94	49697.85	29513.15	72007.00

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-29
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Nonfatal Heart Attacks Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0002	0.0001	0.0002	6.2314	2.6977	10.3893
	0.0809	0.0541	0.1008	2842.252	1477.1121	4716.6587
	0.1102	0.0736	0.1374	3863.1702	2009.0214	6425.21
	0.0496	0.0332	0.0618	1738.0157	905.9255	2890.0491
	0.1627	0.1122	0.1983	5712.5371	3025.9072	9846.1377
	0.0329	0.0227	0.0401	1149.282	611.9268	1890.986
	0.0401	0.0276	0.0489	1411.3754	745.5956	2304.0518
	0.0557	0.0384	0.0679	1943.7031	857.1425	3199.3345
	0.1147	0.078	0.1413	4024.0945	2115.2783	6638.9272
	0.0349	0.0238	0.0429	1225.2681	532.0145	2017.089
	0.045	0.0306	0.0553	1575.4662	829.9398	2598.5491
	0.1035	0.0714	0.1262	3620.5779	1925.464	5950.1079
	0.1148	0.0792	0.1399	4033.7219	2135.2666	6598.4438
	0.1519	0.1048	0.1852	5338.4839	2826.4688	9197.1699
	0.1707	0.1177	0.2081	5962.417	3175.9429	9814.3643
	0.1478	0.1008	0.1815	5171.3857	2251.0068	8535.5771
	0.2213	0.151	0.2719	7756.7036	3730.1807	12784.1143
	0.1935	0.1334	0.2359	6778.6982	3598.8635	11121.3066
	0.116	0.08	0.1414	4069.8674	2157.6084	7020.7407
	0.1999	0.1379	0.2437	7051.6865	3718.8694	11492.1699
	0.1267	0.0873	0.1544	4447.686	1950.5006	7666.0752
	0.205	0.1414	0.2499	7195.0786	3157.3784	11785.1133
	0.239	0.1643	0.2921	8347.5928	3669.0173	13762.5605
	0.0508	0.0343	0.063	1774.842	932.6124	2952.207
	0.0438	0.0299	0.0538	1535.4172	809.6678	2531.2288
	0.0058	0.004	0.0071	203.2879	88.9824	351.8071
	0.0306	0.0211	0.0373	1073.7032	569.0448	1758.474
	0.0355	0.0245	0.0433	1245.9353	660.5159	2095.2034
	0.1906	0.1314	0.2323	6682.7251	2934.7219	11534.373
	0.1294	0.0884	0.1587	4534.9194	2184.1357	7465.6768
	0.0627	0.0423	0.0777	2196.666	944.4894	3641.1069
	0.0392	0.0268	0.0481	1369.3352	599.503	2264.6455
	0.0281	0.0194	0.0343	990.014	523.223	1617.2131
	0.0339	0.0233	0.0415	1189.6074	628.9515	1955.8037
	0.1963	0.1354	0.2394	6868.0112	3023.7795	11286.46
	0.0067	0.0046	0.0081	234.7453	124.353	384.2771
	0.004	0.0028	0.0049	139.7998	74.2721	229.5168
	0.1147	0.0783	0.1409	4046.4893	2119.9165	6996.4385
	0.3255	0.2188	0.4042	11380.9414	4884.9834	18929.709
	0.2653	0.1804	0.3267	9334.5283	4890.7905	15347.6992
	0.051	0.0351	0.0621	1779.2946	784.8293	2929.4146
	0.081	0.0559	0.0987	2837.552	1506.4369	4655.2153
	0.0621	0.0428	0.0757	2187.0842	1155.2018	3758.9487
	1.391	0.9593	1.6958	48855.2695	25875.916	79962.4453
	0.408	0.2814	0.4974	14297.2314	6284.1621	23456.0078
	0.3538	0.244	0.4313	12444.4502	6581.1099	20337.0762
	0.0429	0.0296	0.0523	1512.7948	798.2578	2466.7881
	0.1597	0.1082	0.1972	5605.1226	2938.7073	9256.0264
	0.168	0.1152	0.2057	5879.3882	2573.5427	9683.7988
	0.081	0.0559	0.0988	2837.2563	1507.0389	4658.6094
	0.0833	0.0574	0.1015	2911.7966	1282.6595	4787.5962
SUM	7.16	4.91	8.76	251213.50	124690.93	415558.89

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-30
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Nonfatal Heart Attacks Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0183	0.0103	0.026	669.1523	322.0611	1153.5101
	0.0251	0.0141	0.0356	913.5999	441.4587	1580.9701
	0.0112	0.0063	0.016	406.0304	197.9378	708.7281
	0.0358	0.0201	0.0507	1304.8798	630.9713	2251.5112
	0.0074	0.0041	0.0104	267.6025	129.7729	462.6063
	0.0091	0.0051	0.0128	330.058	160.009	569.9809
	0.0124	0.007	0.0176	455.873	219.7652	783.3618
	0.0259	0.0146	0.0367	943.0783	456.642	1630.9053
	0.0076	0.0043	0.0108	277.1478	134.6139	481.3602
	0.0103	0.0058	0.0145	372.9748	181.1163	646.1464
	0.0233	0.0131	0.0329	847.579	410.8085	1463.8931
	0.0265	0.0149	0.0375	960.9017	468.2491	1665.7729
	0.0342	0.0192	0.0484	1238.3123	603.4553	2150.2905
	0.0362	0.0203	0.0514	1319.1335	638.1976	2282.1831
	0.0321	0.018	0.0456	1170.5747	565.7244	2023.764
	0.0505	0.0284	0.0716	1852.1825	891.675	3180.3674
	0.0447	0.0252	0.0632	1630.7839	790.516	2811.9329
	0.0272	0.0154	0.0385	987.2327	481.5264	1711.1206
	0.0467	0.0263	0.066	1696.0177	825.5728	2934.6875
	0.0284	0.016	0.0402	1029.3799	500.9601	1785.5065
	0.0438	0.0246	0.0621	1595.8871	771.7688	2758.7224
	0.0507	0.0285	0.0719	1843.7351	892.6546	3193.9795
	0.0114	0.0064	0.0162	417.6207	201.4648	720.7079
	0.01	0.0056	0.0141	362.9478	175.8145	627.2315
	0.0013	0.0007	0.0019	48.2923	23.3932	83.3251
	0.0072	0.0041	0.0102	262.5773	127.8721	454.1992
	0.0079	0.0044	0.0112	287.0956	139.5052	497.4214
	0.0411	0.0231	0.0583	1501.2372	724.6547	2588.7996
	0.0282	0.0158	0.0399	1025.7296	496.0481	1773.7411
	0.0147	0.0083	0.0208	538.299	259.392	925.6182
	0.009	0.0051	0.0128	328.1135	159.1839	567.2872
	0.0064	0.0036	0.0091	234.9874	113.934	405.5075
	0.008	0.0045	0.0113	291.566	141.0564	501.7155
	0.043	0.0242	0.061	1559.087	759.2234	2709.6541
	0.0015	0.0008	0.0021	54.483	26.4793	94.3686
	0.001	0.0005	0.0014	34.9084	16.9842	60.2596
	0.0255	0.0143	0.0362	928.8926	449.7935	1606.7937
	0.0753	0.0423	0.1067	2730.9624	1326.6559	4741.2349
	0.0617	0.0347	0.0874	2255.3027	1089.8387	3884.9729
	0.011	0.0062	0.0157	401.8256	194.7253	695.4545
	0.0178	0.01	0.0253	647.4152	314.5029	1122.1686
	0.015	0.0085	0.0211	547.7924	265.3175	941.0758
	0.3134	0.1765	0.4436	11425.2168	5535.2275	19721.3594
	0.094	0.053	0.1329	3413.0947	1661.5309	5911.4731
	0.0867	0.049	0.1224	3169.4399	1537.7626	5448.2319
	0.0127	0.0073	0.0178	462.3158	227.9948	795.8754
	0.048	0.0273	0.0673	1748.5933	857.3801	3002.6738
	0.0419	0.0237	0.0591	1528.5106	742.2364	2629.5842
	0.0206	0.0117	0.029	748.3184	366.0019	1293.4305
	0.0241	0.0138	0.0339	880.9543	432.0223	1511.0146
SUM	1.65	0.93	2.33	59947.70	29081.45	103546.48

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-31
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Upper Respiratory Symptoms Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.2516	0.0804	0.4199	6.5823	1.8587	13.7862
	0.7248	0.2314	1.2096	18.9589	5.3531	39.7104
	0.3176	0.1014	0.53	8.3087	2.3464	17.4015
	0.5863	0.1878	0.9766	15.3392	4.3417	32.0813
	0.5901	0.189	0.9828	15.4369	4.3693	32.2856
	0.2099	0.0672	0.3496	5.4904	1.554	11.4829
	3.798	1.2163	6.326	99.3604	28.1234	207.8077
	3.5936	1.1493	5.9913	94.0113	26.5792	196.7692
	0.4727	0.1512	0.788	12.3673	3.4975	25.8804
	0.5993	0.1917	0.9991	15.6788	4.4335	32.8126
	2.628	0.8416	4.3773	68.7528	19.4601	143.7933
	5.0221	1.6083	8.365	131.3867	37.1882	274.7891
	10.7832	3.4533	17.9607	282.1044	79.848	590.0082
	2.5502	0.8167	4.2476	66.7164	18.8837	139.5342
	0.9914	0.3172	1.6525	25.9358	7.3347	54.2747
	4.976	1.5935	8.2882	130.1806	36.8469	272.2667
	4.1143	1.3176	6.8529	107.6365	30.4659	225.1167
	4.9445	1.5834	8.2356	129.355	36.6132	270.54
	1.3966	0.4473	2.3262	36.5374	10.3417	76.4162
	0.5805	0.1859	0.9669	15.1869	4.2986	31.7626
	0.8592	0.2751	1.4314	22.478	6.3605	47.0202
	0.1808	0.0578	0.3013	4.729	1.3374	9.8962
	0.9535	0.3053	1.5882	24.9447	7.0605	52.1708
	0.0997	0.0319	0.1664	2.6089	0.7372	5.4624
	0.1108	0.0355	0.1845	2.8976	0.8201	6.0601
	0.4141	0.1325	0.6902	10.833	3.0636	22.6694
	0.3771	0.1205	0.6291	9.8645	2.7865	20.6569
	0.2919	0.0934	0.4867	7.6365	2.159	15.9834
	0.2144	0.0686	0.357	5.608	1.5873	11.7288
	0.2144	0.0686	0.357	5.608	1.5873	11.7288
	1.4075	0.4507	2.3443	36.8213	10.422	77.01
	0.2155	0.069	0.3589	5.6378	1.5957	11.7911
	0.1119	0.0358	0.1863	2.9268	0.8284	6.1212
	0.1119	0.0358	0.1863	2.9268	0.8284	6.1212
	0.1022	0.0327	0.1704	2.6726	0.7554	5.5947
	0.418	0.1338	0.6965	10.9353	3.0938	22.8774
SUM	55.21	17.68	91.98	1444.46	408.76	3021.41

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-32
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Upper Respiratory Symptoms Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0394	0.0124	0.0663	1.0309	0.2879	2.1694
	0.1146	0.0361	0.1929	2.9997	0.8377	6.3122
	0.0498	0.0157	0.0838	1.3025	0.3637	2.7409
	0.0838	0.0264	0.141	2.1927	0.6124	4.6138
	0.0858	0.0271	0.1444	2.2458	0.6273	4.7255
	0.0309	0.0097	0.052	0.8087	0.2259	1.7016
	0.5529	0.1744	0.9305	14.4689	4.0413	30.4452
	0.5441	0.1716	0.9156	14.2371	3.9762	29.9579
	0.0687	0.0217	0.1156	1.7978	0.5021	3.783
	0.0915	0.0288	0.1539	2.3934	0.6685	5.0361
	0.3847	0.1213	0.6473	10.0652	2.8113	21.1788
	0.7564	0.2386	1.2728	19.7928	5.5287	41.6467
	1.5794	0.4981	2.6578	41.3286	11.5435	86.9623
	0.3507	0.1106	0.5902	9.1768	2.5628	19.3102
	0.1509	0.0476	0.2539	3.9483	1.1028	8.3079
	0.7508	0.2368	1.2633	19.6451	5.4874	41.3361
	0.6311	0.1991	1.062	16.5146	4.6132	34.7487
	0.7543	0.2379	1.2692	19.7375	5.5134	41.5301
	0.2037	0.0642	0.3428	5.3302	1.4888	11.2156
	0.0804	0.0254	0.1353	2.1043	0.5877	4.4279
	0.1189	0.0375	0.2001	3.1114	0.8689	6.5472
	0.0274	0.0086	0.0461	0.7167	0.2002	1.508
	0.1335	0.0421	0.2246	3.493	0.9755	7.35
	0.016	0.005	0.0269	0.4182	0.1168	0.8799
	0.0158	0.005	0.0266	0.4129	0.1153	0.8687
	0.0612	0.0193	0.103	1.6022	0.4475	3.3714
	0.06	0.0189	0.1009	1.5688	0.4381	3.3011
	0.0457	0.0144	0.0769	1.195	0.3338	2.5146
	0.0302	0.0095	0.0508	0.7892	0.2204	1.6606
	0.0339	0.0107	0.057	0.8866	0.2477	1.8655
	0.2066	0.0651	0.3476	5.4052	1.5097	11.3735
	0.0324	0.0102	0.0545	0.8477	0.2368	1.7837
	0.018	0.0057	0.0303	0.4711	0.1316	0.9913
	0.0222	0.007	0.0374	0.5818	0.1626	1.2241
	0.0213	0.0067	0.0358	0.5574	0.1558	1.1727
	0.0692	0.0218	0.1165	1.8116	0.5061	3.8118
SUM	8.22	2.59	13.83	214.99	60.05	452.37

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-33
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Work Loss Days Based on Maximum 24 Hour Mean Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.6037	0.5308	0.6756	103.1703	90.7171	115.4731
	8.9856	7.8976	10.0611	1535.7091	1349.7607	1719.5171
	8.4491	7.4255	9.4609	1444.0149	1269.0809	1616.9515
	14.5185	12.7611	16.2556	2481.3337	2180.9773	2778.2161
	14.2208	12.5177	15.9008	2430.4473	2139.3762	2717.5793
	10.1982	8.9768	11.403	1742.949	1534.2128	1948.8602
	7.7193	6.7948	8.6312	1319.2865	1161.2883	1475.1465
	14.9206	13.1337	16.6833	2550.0474	2244.6531	2851.3088
	25.5316	22.4576	28.5669	4363.5459	3838.1826	4882.3125
	3.4563	3.0407	3.8665	590.7009	519.676	660.8168
	9.8931	8.7029	11.0681	1690.8032	1487.3983	1891.6238
	17.3077	15.2349	19.3524	2958.0239	2603.7703	3307.4839
	20.3968	17.9541	22.8065	3485.9792	3068.4971	3897.811
	22.2204	19.5592	24.8455	3797.6379	3342.8315	4246.2896
	20.1875	17.7698	22.5724	3450.2019	3037.0046	3857.8069
	25.4432	22.3838	28.4634	4348.4404	3825.574	4864.6167
	11.3609	9.9949	12.7095	1941.671	1708.2003	2172.1543
	24.9648	21.975	27.9142	4266.689	3755.7087	4770.7539
	19.3697	17.05	21.6581	3310.4431	2913.9832	3701.5371
	17.5283	15.4291	19.5991	2995.7292	2636.9597	3349.6433
	19.3574	17.0392	21.6443	3308.3416	2912.1335	3699.1875
	30.8494	27.1549	34.494	5272.4136	4640.9878	5895.2944
	71.8444	63.2294	80.3448	12278.7773	10806.4004	13731.5703
	20.7502	18.2448	23.2254	3546.3716	3118.1792	3969.4114
	7.3593	6.4744	8.2328	1257.7565	1106.5254	1407.0518
	4.4955	3.9571	5.0266	768.3179	676.3039	859.0866
	8.4736	7.4588	9.4747	1448.2085	1274.7706	1619.2994
	40.7663	35.8841	45.5824	6967.2783	6132.875	7790.3896
	28.2693	24.8728	31.6219	4831.4458	4250.9536	5404.4272
	22.0248	19.3656	24.652	3764.2119	3309.7346	4213.2168
	7.4902	6.5904	8.3783	1280.1378	1126.358	1431.9229
	7.3522	6.4716	8.2209	1256.5504	1106.0544	1405.0117
	6.1703	5.4297	6.9011	1054.552	927.9843	1179.4572
	16.1582	14.2231	18.0671	2761.5615	2430.8359	3087.8113
	3.0135	2.6526	3.3695	515.0255	453.3458	575.8704
	0.6048	0.5324	0.6763	103.3677	90.9883	115.5795
	24.0178	21.1301	26.8685	4104.8296	3611.2998	4592.0366
	72.4192	63.6645	81.0704	12377.0098	10880.7734	13855.5791
	125.0837	110.0246	139.9536	21377.7988	18804.0781	23919.1797
	7.3758	6.4924	8.2471	1260.578	1109.6107	1409.5021
	17.3814	15.2998	19.4349	2970.6279	2614.8645	3321.5762
	10.2351	9.0093	11.4442	1749.2542	1539.7629	1955.9102
	45.2997	39.8746	50.6514	7742.0825	6814.8887	8656.7285
	62.3329	54.8679	69.6969	10653.1846	9377.3555	11911.7471
	32.6156	28.7095	36.4687	5574.2588	4906.6836	6232.7983
	8.5799	7.5524	9.5936	1466.3812	1290.7668	1639.6188
	52.2196	45.925	58.4365	8924.7441	7848.9468	9987.2676
	10.7044	9.4198	11.9722	1829.4729	1609.9205	2046.1373
	7.8972	6.9513	8.8303	1349.6963	1188.0377	1509.1704
	6.794	5.9804	7.5967	1161.1549	1022.0945	1298.3333
SUM	1075.21	946.07	1202.67	183762.22	161691.37	205546.08

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.

Table A-34
BenMAP Pooled Incidence and Valuation Results and 90% Confidence Intervals (CI) for
Work Loss Days Based on Annual Average Concentrations¹

	Annual Incidence Per Grid-Cell	90% CI		Annual Cost Per Grid-Cell in 2000\$	90% CI	
		5% LCL	95% UCL		5.5% LCL	95.5% UCL
	0.0961	0.0839	0.1083	16.4259	14.3316	18.5165
	1.4626	1.2761	1.6488	249.968	218.0889	281.7903
	1.3888	1.2117	1.5656	237.3543	207.0846	267.5701
	2.3658	2.0641	2.667	404.3335	352.7706	455.804
	2.1282	1.857	2.399	363.7322	317.3751	410.0011
	1.5531	1.3552	1.7506	265.4292	231.6066	299.1861
	1.1901	1.0384	1.3414	203.3912	177.4772	229.2543
	2.2744	1.9846	2.5637	388.7148	339.183	438.1505
	4.0332	3.5191	4.5463	689.3023	601.4378	777.002
	0.5247	0.4578	0.5914	89.6712	78.2385	101.083
	1.5759	1.3751	1.7764	269.3413	235.0154	303.6015
	2.6522	2.3143	2.9895	453.288	395.531	510.9322
	3.2156	2.806	3.6244	549.5679	479.5641	619.4311
	3.4075	2.9733	3.8408	582.3624	508.1597	656.4202
	2.908	2.5372	3.2781	496.9977	433.6321	560.2472
	3.8358	3.3467	4.324	655.5742	571.9851	739.011
	1.8054	1.5753	2.035	308.5584	269.2362	347.8051
	3.9425	3.4403	4.4437	673.8063	587.9786	759.4612
	3.1096	2.7136	3.5048	531.4607	463.7766	599.0062
	2.7986	2.4422	3.1543	478.3071	417.3888	539.1014
	2.956	2.5794	3.3319	505.2072	440.8325	569.4566
	4.4762	3.9056	5.0459	765.0266	667.495	862.3781
	10.4061	9.0792	11.7306	1778.4827	1551.7084	2004.8457
	3.3126	2.8902	3.7342	566.1454	493.9588	638.2006
	1.1642	1.0159	1.3123	198.978	173.6194	224.288
	0.7269	0.6343	0.8192	124.2257	108.4062	140.0126
	1.285	1.1212	1.4484	219.613	191.6274	247.5446
	5.9774	5.2154	6.7379	1021.5814	891.3555	1151.5641
	4.2514	3.7093	4.7924	726.5897	633.9528	819.0565
	3.6746	3.2063	4.142	628.0166	547.9764	707.9044
	1.1924	1.0405	1.3441	203.799	177.831	229.7163
	1.151	1.0043	1.2973	196.7074	171.6487	221.7161
	1.003	0.8752	1.1305	171.4207	149.5859	193.2116
	2.4104	2.1032	2.717	411.9592	359.4539	464.3648
	0.4608	0.4021	0.5195	78.7618	68.726	88.7782
	0.0996	0.0869	0.1122	17.0182	14.8515	19.1804
	3.7091	3.2363	4.1811	633.9186	553.1107	714.5756
	11.9794	10.4522	13.5037	2047.3738	1786.3678	2307.8958
	20.4135	17.8123	23.0097	3488.8286	3044.2615	3932.533
	1.0868	0.9483	1.2251	185.7495	162.0723	209.3823
	2.6044	2.2725	2.9357	445.1208	388.3915	501.7419
	1.6927	1.4772	1.9077	289.2933	252.4626	326.0465
	6.9605	6.0737	7.8457	1189.6127	1038.0391	1340.8895
	9.8086	8.5591	11.0555	1676.3632	1462.8243	1889.474
	5.4912	4.7922	6.1887	938.4895	819.0317	1057.6908
	1.7803	1.5543	2.0057	304.2733	265.6462	342.7979
	11.3208	9.8828	12.7551	1934.809	1689.0431	2179.9502
	1.8521	1.6163	2.0873	316.5341	276.2437	356.7379
	1.3845	1.2083	1.5602	236.6161	206.5116	266.6534
	1.3749	1.2003	1.5491	234.9814	205.1404	264.7453
SUM	172.27	150.33	194.18	29443.08	25692.04	33186.71

Notes:

LCL = Lower Confidence Limit

UCL = Upper Confidence Limit

¹ Within a defined grid, incidence and cost are estimated for every grid-cell that has a population associated with it that corresponds demographically to the study populations of the selected epidemiological studies for each health endpoint. Grid-cell estimations are then summed to represent the entire grid, in this case, an 800 meter grid around PRGS.